DOCUMENT RESUME

ED 149 719 IR 005 487

AUTHOR	Hess, Ronald; Kantar, Phyllis
TITLE	MODIA: Vol. 5. A User's Guide to the Cost Model.
INSTITUTION	Rand Corp., Santa Monica, Calif.
SPONS AGENCY	Air Force Directorate of Operational Requirements and Development Plans, Washington, D.C.
REPORT NO	R-1704-AF
PUB DATE	Oct 77
CONTRACT	F49620-77-C-0023
NOTE	337p.; Appendix D will not reproduce and was not included; Document not available in hard copy due to marginal legibility of original; For related documents, see ED 074 738, 075 996, 077 214, 145 805-806, 145 820 and IR 005 486
AVAILABLE FROM	Rand Corporation, Santa Monica, Calif. 90406 ($5.00)
EDRS PRICE	MF-$0.83 Plus Postage. HC Not Available from EDRS.
DESCRIPTORS	*Computer Oriented Programs; *Cost Effectiveness; Course Organization; *Educational Alternatives; *Educational Planning; Input Output; Instructional Design; Instructional Systems; *Military Training; Models; Performance Criteria; *Program Costs
IDENTIFIERS	Method of Designing Instructional Alternatives

ABSTRACT

MODIA (Method of Designing Instructional Alternatives) was developed to help the Air Force manage resources for formal training by systematically and explicitly relating quantitative requirements for training resources to the details of course design and course operation during the planning stage. This report describes MODCOM (MODIA Cost Model), a FORTRAN-programmed computer model for estimating the investment and operating costs associated with alternative training course designs; a separate appendix describes the program. The model uses instructional policy data input to the User Interface (UI), resource requirements generated by the Resource Utilization Model (RUM), and cost and manning factors supplied by the planner or, in some cases, stored in the program, to project total course costs for up to five years. Options are available as to which costs should be included and how they should be computed. The basic equation parameters of all estimating relationships have been completely generalized in order that the model may accommodate a wide range of alternatives; e.g., number of entrants, course duration, grade structure of the instructor force, the levels of staff and base support, pay and allowance factors, and the types of courseware and hardware used. The five outputs of MODCOM are: (1) graduates by student type; (2) student and staff man-years; (3) courseware, hardware, and facility characteristics and requirements; (4) total course costs by functional element; and (5) total course costs by program and appropriation. (Author/DAG)

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MODIA: Vol. 5
A User's Guide to the Cost Model

Ronald Hess and Phyllis Kantar

A Project AIR FORCE report
prepared for the
United States Air Force

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PREFACE

This report documents research conducted under Project AIR FORCE (formerly Project RAND) by The Rand Corporation. The work described here was performed as part of the project entitled "Analysis of Systems for Air Force Education and Training" under Rand's Manpower, Personnel, and Training Program. It is the fifth in a series presenting Rand's MODIA planning system. MODIA, a Method of Designing Instructional Alternatives, is a system of people, computer programs, and procedures that allows the rapid specification and simulation of courses of instruction during the early stages of instructional design. It augments and can be used in the present Air Force instructional systems development process.

The development of MODIA has been supported by the Deputy Chief of Staff/Personnel, Headquarters United States Air Force, and the Air Training Command, especially DCS/Technical Training, the Training Development Directorate, and personnel at the Keesler School of Applied Aerospace Sciences. It is part of Rand's continuing research effort in the areas of planning and management in education, education technology, and the cost and effectiveness of education systems.

This report describes the Cost Model, a FORTRAN-programmed computer model for determining all investment and operating costs associated with a given course design.

The series of MODIA reports includes:

R-1700-AF, *MODIA: Vol. 1, Overview of a Tool for Planning the Use of Air Force Training Resources*, Polly Carpenter-Huffman.

R-1701-AF, *MODIA: Vol. 2, Options for Course Design*, Polly Carpenter-Huffman.

R-1702-AF, *MODIA: Vol. 3, Operation and Design of the User Interface*, Polly Carpenter-Huffman, Misako Fujisaki, and Ray Pyles.

R-1703-AF, *MODIA: Vol. 4, The Resource Utilization Model*, Margaret Gallegos.

R-1704-AF, *MODIA: Vol. 5, A User's Guide to the Cost Model*, Ronald Hess and Phyllis Kantar.

SUMMARY

This report describes MODCOM (MODIA Cost Model), a FORTRAN-programmed computer model for estimating the investment and operating costs associated with alternative training course designs. It uses instructional policy data input to the User Interface (UI)[1], resource requirements generated by the Resource Utilization Model (RUM),[2] and cost and manning factors supplied by the planner or, in some cases, stored in the program, to project total course costs for up to five years. Options are available as to which costs should be included and how they should be computed.

The basic equation parameters of all estimating relationships have been completely generalized in order that the model may accommodate as wide a range of alternatives as possible. However, the underlying functional relationships have been built into the model and cannot be changed by the user. Specific manpower and cost categories for which estimates are developed include:

Manpower

Students
Instructors
Curriculum Personnel
Hardware Maintenance Personnel
Facilities Maintenance Personnel
Training Administrative Personnel
Base Operating Support Personnel
Medical Personnel

Cost Categories

Courseware Procurement
Hardware Procurement
Facility Construction
Pay and Allowances
  Students
  Instructors
  Support Personnel
Permanent Change of Station (PCS)/Temporary Duty (TDY)
Instructor Training
Miscellaneous Operating Expenses

Among the alternatives that may be examined are changes in the number of entrants; course duration; grade structure of the instructor force; the levels of staff

[1] See Polly Carpenter-Huffman, *MODIA: Vol. 2, Options for Course Design*, R-1701-AF; and Polly Carpenter-Huffman, Misako Fujisaki, and Ray Pyles, *MODIA: Vol. 3, Operation and Design of the User Interface*, R-1702-AF.

[2] Margaret Gallegos, *MODIA: Vol. 4, The Resource Utilization Model*, R-1703-AF.

and base support; pay and allowance factors; PCS/TDY factors; and the types of courseware and hardware used.

The five outputs produced by MODCOM summarize: graduates by student type; student and staff man-years; courseware, hardware, and facility characteristics and requirements; total course costs by functional element; and total course costs by program and appropriation.

Although the Cost Model is directly related to the other components of the MODIA system, it may be operated independently. That is, if the analyst is interested in determining the cost of an existing course for which all resource quantities are known, then it is not necessary to exercise the User Interface and the Resource Utilization Model.

ACKNOWLEDGMENTS

Acknowledgments are due many individuals in the Air Force and at Rand for the assistance they provided throughout the preparation of this report. Rand colleagues who suggested methodologies, contributed written sections, and reviewed the manuscript include S. L. Allison, B. E. Armstrong, M. N. Beltramo, G. R. Blais, R. Bretz, M. B. Carpenter-Huffman, M. M. Gallegos, R. L. Petruschell, and J. F. Schank.

The following Air Force personnel provided information, advice, and review assistance:

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I. INTRODUCTION

This report describes MODCOM (MODIA Cost Model), a FORTRAN-programmed computer model for estimating the costs of conducting Air Force resident technical training courses. The introduction to this report provides an overview of MODIA, including a brief survey of the MODIA sample case. The remainder of the report explains MODCOM operation in terms of model prerequisites (Section II); input preparation (Section III); the output structure (Section IV); and estimating relationships (Section V). The appendixes provide a brief description of technical training organization (Appendix A); performance characteristics of typical media hardware (Appendix B); the FORTRAN program listing and program documentation (Appendix C); and the relevant portions of UI/RUM output from the minimum load case (Appendix D).

A. OVERVIEW OF MODIA

The Problem

The Air Force is heavily involved in training; in fact, in peacetime almost all Air Force activities can be thought of as training of one kind or another. But the most visible and highly structured of these activities is the training conducted by Air Training Command (ATC)—basic military training, flying training, and technical training. This is a multibillion dollar enterprise requiring the support and involvement of over 12 percent of Air Force personnel.

The largest single component of ATC is devoted to formal technical training, which prepares Air Force personnel for jobs ranging from aircraft maintenance to personnel administration. In 1976, some 150,000 persons—over a quarter of the force—will graduate from formal courses given in established technical schools. The operating cost of this activity will be over $600 million; 9 percent of Air Force personnel will be engaged in such training at any particular time. Because of its large student load, formal technical training offers rich opportunities for realizing large dollar savings even though savings are small in terms of the individual student.

Many opportunities to improve the management of training resources arise in the normal course of events. There are currently some 300,000 different course hours in the curriculum, of which over a third are substantially revised or newly prepared annually. Changes in force composition, introduction of new weapon systems, and changes in operating policies of other commands all affect the subject matter of training and can have direct effects on requirements for training equipment and indirect effects on training operations. Shifts in training-related characteristics of the student population (such as general academic ability or previous experience related to the subject matter of the course) may require changes in teaching method or shifts in subject matter emphasis. Changes in school policy toward classroom management may encourage the replacement of familiar methods with new teaching materials or techniques. Finally, variations in requirements

for the output of graduates obviously and strongly affect the availability of and requirements for training resources. Clearly, the design and redesign of courses are important tasks that could lead to substantial improvements in training.

The current Air Froce approach to course design, termed Instructional System Development (ISD), is outlined in AFM 50-2.[1] ISD is a systematic procedure for relating the content and conduct of training to needs in the field. This procedure consists of five steps:

1. Analyze system requirements—that is, determine what tasks should be performed in the job.
2. Define education or training requirements—that is, determine how and where performance of these tasks will be learned.
3. Develop the objectives and tests for instruction.
4. Plan, develop, and internally validate instruction.
5. Conduct instruction and evaluate its effectiveness both internally and in the field.

In carrying out these steps, training developers are guided by the general principles stated in AFM 50-2, tempered by their own judgment and past experience and by existing school policies and procedures.[2] Such expertise is requisite to skillful application of ISD, but course planners have lacked clerical assistance in a key area. Specifically, they have had no way to examine the requirements for training resources implicit in a particular course design. Instead, to estimate resource requirements, they have had to use planning factors (e.g., the average student-to-instructor ratio) based on past school experience. As a result, resource requirements have entered the design process only in a gross, subjective fashion or after course design was completed. The demands for bookkeeping and computation attendant on constructing and costing a course design have meant that only rarely has more than one design been considered during planning.

Purpose of MODIA

MODIA was developed to help the Air Force manage resources for formal training by systematically and explicitly relating quantitative requirements for training resources to the details of course design and course operation during the planning stage. *Course design* includes the content and sequencing of subject matter and tests; teaching methods and the roles of instructors and other training personnel; the assignment of media, training equipment, and facilities; the characteristics of the trainees; and policies for the management of student progress. *Course operation* describes how all of these elements work together to affect student progress through the course and the resulting requirements for and use of training resources. There were two objectives in developing MODIA for designing courses at this level: (1) to help course developers consider approaches not incorporated in available planning factors, and (2) to relate resource use to the details of

[1] Department of the Air Force, *Instructional System Development*, AF Manual 50-2, HQ United States Air Force, Washington, D.C., July 31, 1975.

[2] Quantitative approaches to training development are partly incorporated at step 1, in establishing the tasks commonly performed in the field, and at steps 4 and 5, in internal validation and field evaluation.

course design so that course developers will be encouraged to consider *alternative* designs. As the acronym implies, the consideration of alternatives is MODIA's primary objective.

MODIA is *not* a prescription for training, nor is it an optimizing model; rather, it is neutral with regard to the training effectiveness of a course design in terms of student learning or with regard to the desirability of a course design in terms of training policy. Instead, through an interactive, iterative process it encourages planners to consider, for example:

- The implications of the subject matter for requirements for training resources and teaching strategy;
- Characteristics of students that affect learning and instruction;
- The effects of course management policies and teaching strategy on learning and on the use of training resources; and
- How changes in one element of course design will affect the others.

MODIA has been designed primarily for the use of the five ATC technical schools, which account for over 90 percent of the student load in technical courses. Each school has several departments, each dealing with a major career area, and each department has several branches that are responsible for training in a related group of courses.[3] MODIA is directed to the course level, because a student usually takes only one course at one school to qualify for his initial job assignment.

The most fruitful applications of MODIA will probably be in step 4 of ISD—in the planning and development of instruction. However, like ISD itself, MODIA can be applied at any of several stages of planning. For example, MODIA does not require that all objectives and tests be stated in criterion-referenced terms or even that all be identified before it can give insight into course development. As with the steps in ISD, among which feedback and interaction should refine and improve the ultimate result,[4] MODIA should be applied at different levels of generality to help guide the definition of training requirements and the development of objectives and tests. For example, MODIA may show that with a given student load there is not enough training equipment for each student to have sufficient practice on it. This might suggest that some of the equipment-oriented objectives could be redirected toward less expensive mockups, computer simulation, or other acceptable substitutes. Thus, MODIA has numerous slots for descriptive data that do not all have to be filled accurately before results can be useful. Moreover, MODIA can be an aid for planning only a portion of a course (e.g., a block or single module of instruction) or for planning up to four courses that use the same training resources simultaneously.

MODIA Components

People are the most important component of MODIA. As with any tool, MODIA's product is only as good as its users can make it. Because of their importance, personnel roles and requirements in MODIA are discussed separately below.

Because the bulk of MODIA resides in computer programs, users may in a very short time generate a blueprint for instruction and estimates of the resources

[3] Additional information on technical training center organization may be found in Appendix A.
[4] AFM 50-2, pp. 1-2.

needed to produce and operate the resulting training course. More important, computerization encourages users to design and compare alternative plans before any particular plan is developed and put into operation, often a long and expensive process. Once a baseline course design has been constructed, alternatives can be generated in a matter of hours or minutes, depending on the degree to which they depart from the baseline and the richness of the baseline design.

MODIA has four components: the description of options for course design, the User Interface (UI), the Resource Utilization Model (RUM), and the Cost Model (MODCOM). Figure 1 shows the interactions between the user and these components. Note that MODIA has two main points for entering data—the UI and MODCOM—rather than automatically translating RUM output into course cost. This is because decisions concerning costing procedures and policies are often contingent on course operation. The additional entry point also permits planners to refine the design for preferred course operation before undertaking a complete cost analysis.

The separation of entry points has a further advantage; it permits MODCOM to capture most of the information that is unique to ATC course planning, so that the UI and RUM are useful for planning training in a much wider range of applications. Thus, the UI and RUM can give insights for planning parts of courses, rather than full courses, or courses given in the Air Force Academy, the Air University, or other Air Force agencies. Conversely, ATC can use MODCOM independently of the UI and RUM to analyze course cost without requiring access to the considerably larger resources (computer capacity and MODIA analysis) required to support the UI and RUM.

The *Options for Course Design* provides an overview of the data and information the UI will ask for, the range of choices available at each entry point, and when available, references to research results concerning those choices.

The UI is an interactive computer program; that is, the user enters data step by step in response to questions from the computer. The choice of question the computer asks at a given point is influenced by preceding responses from the user; hence the term "interactive." Also, at many intermediate points the computer processes the set of answers given to that point and displays the results to guide further decisionmaking or to allow the user to recycle through the process if he is dissatisfied with the results at that point. In this way the UI produces a course description in computer-compatible data that interrelates course content, teaching strategy, student characteristics, and resource assignments.

MODIA inputs these data automatically to the RUM, which simulates the way in which student progress through the course generates requirements for training resources. The RUM is a "batch-process" program: It receives all of the inputs in a single batch, not step by step as in an interactive program. It also produces its outputs in a single batch. The outputs are detailed reports on course operation, including student flow patterns and waiting times as well as resource demand and use.

Planners will rarely be satisfied with the results of the first complete operation of the UI and RUM and will repeat the process several times before they prepare the input required for MODCOM. They may, however, need to compare rough, order-of-magnitude cost estimates to help them select from among the preliminary course designs.

MODCOM, also a batch process program, estimates the investment and operat-

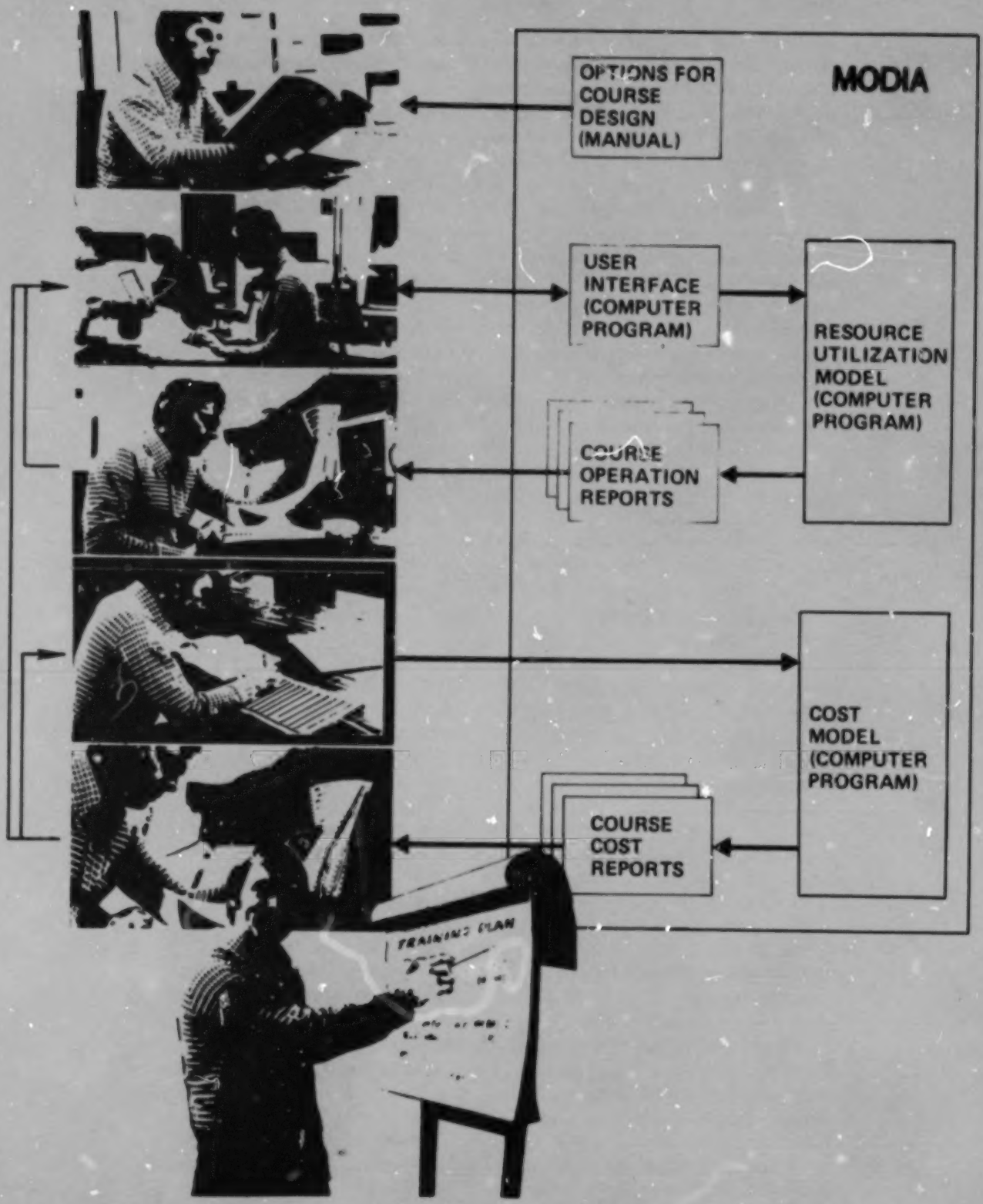

Fig. 1—Interactions between the user and MODIA components

ing costs associated with a given course design. Using instructional policy data input to the UI, resource requirements generated by the RUM, and cost and manning factors supplied by the planner or, in some cases, stored in the program, it projects total course costs for up to five years. Several options are available as to which costs should be included and how they should be computed, and output is provided in both functional and budgetary formats.

The planner, if the cost report reveals a feature of course operation which he considers unwarrantably expensive, may either substitute less expensive resources or modify the course design. In the first case, only the Cost Model will require iteration (assuming equal effectiveness for the substitute resources); in the second case, the UI, RUM, and Cost Model will all require iteration. Subsequent passes, however, rarely entail complete redesign of the course and often take only a small fraction of the time and attention that creating the initial case required.

When the planners are satisfied with both the course operation and course cost reports for a specific course design, they have at hand the bulk of the elements for a training plan and need only synchronize the plan with other planning activities at the school to put it in final form.

Personnel

Two groups of people should be involved in any application of MODIA in planning—those who are expert in using MODIA ("the MODIA team") and those who have knowledge and experience in the areas of subject matter and planning particular to the course being developed (the "subject matter experts"). Figure 2 shows the configuration currently being used at the Keesler School of Applied Aerospace Sciences.

Members of the MODIA team need not (and probably should not) have extensive experience with computers. By background and bent they should be problem solvers first, computer experts second. They need to be familiar with course planning and school operations, so that they can draw out the subject matter experts' best judgment on what constitutes effective instruction and help them distinguish between what is usually done (for convenience or by tradition) from what is needed. They should also have a feeling for how far school policies can be adjusted, if it would be desirable to do so, and be able to act as liaison among different organizational entities within the school whose interests may clash within a given training course design.

Members of the MODIA team need initial training in the use of the system and need to apply the system frequently enough to maintain their expertise. They should be fully aware of MODIA's features and operation, particularly of the alternatives it encompasses; should have a good feel for the effects of different choices of input on MODIA outputs; and should be able to guide the subject matter experts in choosing the most efficient alternatives.

The subject matter experts are people who normally plan and develop courses. They need an understanding not only of the subject of the course but of the student population and the teaching methods that work best for them. They should be familiar with school policy and should know what resources are likely to be available to the course and what they will cost. All of this information need not reside in a single person (nor does it in the current development process). Perhaps most important, the subject matter experts need to be flexible—able to interact with the

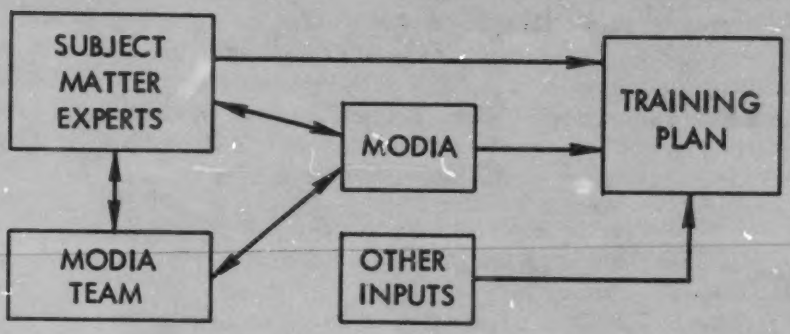

Fig. 2—Configuration currently in use at Keesler School of Applied Aerospace Sciences

MODIA team so that the special capabilities of both groups can be fully applied.

B. DESCRIPTION OF COST MODEL

The purpose of this user's guide is to explain the reduction of the diverse resource-requirement data generated by the other MODIA components to a common dollar denominator. Since the probable users of MODCOM will be general problem-solvers and not necessarily cost analysts, every effort has been made to provide as much cost-factor guidance as possible. However, this user's guide does not provide any guidance on resource selection, a topic which has been covered in another MODIA report.[5]

Resource classes considered in MODCOM cost projections are (1) manpower, (2) courseware, (3) hardware, and (4) facilities. Following are examples of each resource class:

Resource Class	*Examples of Specific Resources*
Manpower	Students, instructors, support personnel
Courseware	Films, slides, texts, computer software
Hardware	Projectors, simulators, learning carrels
Facilities	Classrooms, laboratories, hangars

The Cost Model may be used at any desired level of detail. The course planner may use MODCOM to determine rough, order-of-magnitude costs of a course design in which only a few of the key resources have been identified. Or, given a comprehensive list of resources, he may wish to exclude specific cost elements associated with certain resources because he feels they are not significant. Furthermore, it is important to note that although the Cost Model is directly related to the other components of the MODIA system, it may be operated independently. That is, if the analyst is interested in determining the cost of an existing course for which all resource quantities are known, then it is not necessary to exercise the User Interface and the Resource Utilization Model.

[5] *MODIA: Vol. 2, Options for Course Design*, R-1701-AF.

As stated previously, MODCOM estimates the total course costs on the basis of the instructional policy data originally entered in the UI (like course failure rate and student entry interval), resource requirements generated by the RUM (such as course duration and the required quantity and utilization rate of specified types of hardware), and cost and manning factors supplied by the planner. This latter category may be further subdivided into

- Course-specific factors that the planner must stipulate (such as support-personnel manning factors and the unit procurement costs of hardware and courseware).
- Standard ATC-wide factors (such as pay and allowance and PCS/TDY factors), which are stored as part of the program but are subject to override by the planner if more accurate information is available.

The process of ensuring that UI input and RUM output are acceptable as MODCOM input is explained in Section II. Guidance (i.e., typical values) concerning those inputs that must be stipulated by the planner is provided in Section III. Standard ATC-wide cost factors, taken from official AF planning documents, are also provided in Section III.

The basic equation parameters of all estimating relationships have been completely generalized so that the model may accommodate as wide a range of alternatives as possible. However, the underlying functional relationships have been built into the model and cannot be changed by the user. Specific manpower and cost categories for which estimates are developed include:

Manpower

Students
Instructors
Curriculum Personnel
Hardware Maintenance Personnel
Facilities Maintenance Personnel
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Cost Categories

Courseware Procurement
Hardware Procurement
Facility Construction
Pay and Allowances
  Students
  Instructors
  Support Personnel
Permanent Change of Station/Temporary Duty
Instructor Training
Miscellaneous Operating Expenses

The five outputs produced by MODCOM summarize: graduates by student type (Output 1); student and staff man-years (Output 2); courseware, hardware, and

facility characteristics and requirements (Output 3); total course costs by functional element (Output 4); and total course costs by program and appropriation (Output 5).

Analytic Framework

DoD Instruction (DoDI) 7041.3, "Economic Analysis and Program Evaluation for Resource Management,"[6] outlines policy guidance and establishes a framework for consistent application of economic analysis on proposed programs, projects, and activities. Consequently, the general intent pursued in the development of MODCOM was to tailor the model as much as possible to the training center environment (e.g., cost output by appropriation, typical values based on training center experience) subject to the guidance of DoDI 7041.3. The following paragraphs summarize some of the more important conceptual issues encountered in the formulation of MODCOM.

Economic Life. The time-horizon selected for MODCOM was five years, since that is roughly the maximum length of time a technical training center course continues before being subject to a complete revision.

Relevant Costs. The costs generated by MODCOM are intended to include only those costs which are both incremental (lie in the future) and variable (with respect to the decision to offer a particular course). Costs incurred as the result of past decisions and costs unaffected by the existence or size of the course under analysis are not considered relevant to the selection of an optimum course design.

Treatment of Inflation. Consistent comparisons of alternatives require cost estimates in constant dollars (dollars with equivalent purchasing power). Current dollar estimates, which reflect changes in the general price level, are useful only for financial planning. Therefore, since consistent comparison of alternatives is a goal of MODCOM and financial planning is not, all cost estimates are in constant dollars.

Present Value Cost. DoD requires that when selecting the most cost-effective alternative, costs and benefits be in present value (discounted) form. MODCOM, utilizing an annual rate of 10 percent as prescribed by OMB Circular No. A-94,[7] provides the present value cost of all alternatives.

Imputed Value. "Inherited resources," which normally require no budgetary outlay, must be included in all DoD cost analyses at their imputed value:

> The investment for a given project may consist of assets to be acquired *plus* existing assets, i.e., assets already on hand. However, the value of such existing assets will be included in the investment costs only when the existing asset is currently in use (or has an alternative, planned use) on some other project or is intended for sale. When such alternative use of the existing asset will result in a cash outlay for some other project which would otherwise not be incurred, or will deprive the Government of the cash planned to be realized by sale, the value will be included in the analysis.
>
> Such existing assets will be included at their fair market value (as measured by market price, scrap value, or alternative use) and the basis for arriving at the estimate will be documented.[8]

[6] DoD Instruction 7041.3, "Economic Analysis and Program Evaluation for Resource Management," Office of the Assistant Secretary of Defense (Comptroller), Washington, D.C., October 18, 1972.

[7] OMB Circular No. A-94, "Discount rates to be used in evaluating time-distributed costs and benefits," Office of Management and Budget, Washington, D.C., March 27, 1972.

[8] DoD Instruction 7041.3, p. 3.

Residual Value. The residual value of assets expected to be on hand at the end of the economic life of the course must be treated as a reduction in the cost of the particular alternative for which the use of these assets is intended. The residual value will be equal to the fair market value as determined by sale price, scrap value, or alternative use value.

Limitations on MODCOM Application

Short-Range Budgeting. The model is intended for comparative planning only and is not suitable for solving short-term budgeting problems. There are three reasons for this. First, it was not possible to provide a precise matching between functional cost elements and program/appropriation cost elements. For example, courseware production costs, which are normally a combination of labor charges (Military Personnel Appropriation) and material charges (Operations and Maintenance (O&M) Appropriation), are assigned in their entirety to the O&M Appropriation. Second, the imputed value of inherited resources and the residual value of terminal resources, neither of which result in budget alterations, must be included at their imputed value in all DoD cost analyses. And third, budgeting is frequently subject to nuances in the practices of individual bases.

Nonresident Training. The model is designed for analysis of resident courses only. Costs for field training, contractor training, training by other DoD agencies, and on-the-job training (OJT) are not treated by MODCOM; without such costs, comparisons, as, for example, between OJT and resident training, cannot be made.

Intermittent Schedule. The explanation of the Cost Model contained in this report assumes a course given on a continuous, not an intermittent, basis. The model may be used to estimate costs of a course given intermittently, however, if the planner is willing to make decisions on how the course's resources are to be allocated during the gaps between courses.

C. MODIA SAMPLE CASE

The remainder of this section is devoted to a brief survey of the MODIA sample case, an illustrative example developed and carried throughout this volume to demonstrate the use of MODCOM in the context of the entire MODIA system.

The MODIA sample case is based on the first major section (or "block")[9] of course 3ABR30431, Flight Facilities Equipment Repairmen, as taught at the Keesler School of Applied Aerospace Sciences in the fall of 1973 and described by Keesler personnel who were expert in this particular subject matter.

This block of the course oriented the student to general characteristics of the job for which he was being trained and taught him fundamental skills and procedures for maintaining the AN/URN-5 low frequency beacon. Almost all students who entered the course had completed an 18-week course in electronic principles (3AQR30020). As of October 1973, the Flight Facilities Equipment Repairmen course took 17 weeks; thus the total training for those who graduated was 35 weeks.

[9] "Block" is ATC terminology for a portion of a course that teaches one or two major topics. Frequently, as in this example, a block deals with a piece of major equipment.

Students taking this course had to have scored at or above the 80th percentile in the Electronic Aptitude battery of the Airman's Qualifying Examination. They therefore tended to be above-average airmen, both in general academic ability and in their knowledge of electronics.

Training Block Design

The content, teaching method, student entries and repeats, and resource constraints of the training block are as follows:

Training Content. The major objective of the block was to teach airmen to maintain the AN/URN-5 low frequency beacon, a ground-based device used in air navigation. Maintenance consisted of various procedures for servicing the beacon, troubleshooting the beacon when it malfunctioned, checking the beacon during aircraft flight, and installing the beacon in a flight facility. For the last two tasks, airmen were taught only the procedures to be followed; they did not actually perform them.

The example includes the following content, sequence, and time required for instruction:

1. Test equipment: the trainee was familiarized with the equipment used to service and test the AN/URN-5 (2.5 hours).
2. System familiarization: the trainee learned the components of the AN/URN-5 and how to read the schematics associated with it (8 hours).
3. Servicing: the trainee learned to perform a simple procedure for servicing the beacon (.5 hour).
4. Schematics: the trainee learned to analyze more detailed schematics for the system (6 hours).
5. Servicing: the trainee was then taught more complex procedures for servicing the AN/URN-5 (1.5 hours).
6. Principles of troubleshooting: he was next taught the fundamental principles to be applied in troubleshooting electronic equipmnet (1.5 hours).
7. Troubleshooting AN/URN-5: the trainee learned to find the cause of malfunctions induced by the instructor (1.5 hours).
8. Flight checking: the trainee learned the procedures used for checking beacon operation during aircraft flight (.75 hour).
9. Installation: the trainee learned procedures for installing the beacon in a flight facility (.75 hour).
10. Written test: a test was given that emphasized the trainee's ability to read schematics (.5 hour).
11. Practical test: the trainee's ability to perform one of the servicing procedures was then tested (.5 hour).
12. Critique: the block ended with the instructor discussing test results with the class (.25 hour).

Teaching Method. The instructor used the discussion-demonstration method to teach the required facts and concepts and supplemented this classroom work with assignments for home study. He spent most of his time guiding student practice in reading schematics. Students performed on the equipment (servicing and troubleshooting) in teams of two, with the instructor providing guidance as needed.

Student Entries and Repeats. A maximum of 16 students was expected to enter each week. From past experience, Keesler subject matter experts expected 15 percent of the students to do so badly on the test that they would have to take the block over again. No student would be eliminated from the course on the basis of test results.

Resource Constraints. Major non-media resources used in the MODIA sample include the following:

Resource Unit	*Maximum Number of Trainees per Unit*
Personnel	
Instructors	10 classroom or 4 laboratory
Room monitors	12
Lab monitors	6
Hardware	
AN/URN-5 LF beacon	2
Signal generator	2
Test set No. 1	2
Test set No. 2	2
Facilities	
Classroom	10
Laboratory	10

MODIA Output

The above information was entered into the User Interface for two distinct student entry rates: 8 (minimum load case) and 16 (maximum load case) per 30 course-hours. The data was then transferred to the Resource Utilization Model where it was used to simulate course operations.[10] For the maximum load case, MODIA shows that although the block length is just over 24 hours (24 hours and 15 minutes), the average time a passing student spends in the course (see p. 19) is more nearly 28.5 hours because of the percentage of students who must repeat the block and because repeating students have to wait to join classes entering later. Similarly, although without student repeats the average student load would be 12.8 students (because the block length is shorter than the entry interval), the repeats make it actually nearly 16 students. Finally, resources have been supplied to meet peak demands, but as these peaks occur only a few times during the course (when students perform on equipment), most resources are used very little (see p. 20). For example, the low frequency beacons are used only 22 percent of the time; instructors, only 37 percent of the time.

The MODCOM portion of the MODIA sample case, which is developed in Sections II and III, is a five-year, time-phased cost estimate based on the two separate UI/RUM runs. The maximum load case represents the third (or peak) year while the minimum load case represents the first (or phase-in) and fifth (or phase-out) years. Values for the second and fourth years are an interpolation of the simulation values. According to the MODCOM output (see p. 87), this block of instruction, including media resources, would cost $1.2 M. Approximately 73 per-

[10] The portions of UI/RUM output relevant to the operation of the Cost Model are contained in Section II (maximum load case) and Appendix D (minimum load case).

cent of this total is for student, instructor, and support personnel pay and allowances. Another 19 percent is accounted for by courseware, hardware, and facility procurement, while the remaining 8 percent is expended on miscellaneous items such as instructor PCS and hardware repair parts.

II. MODEL PREREQUISITES

This section explains the procedures involved in preparing UI/RUM output as MODCOM input. These procedures, for which worksheets have been provided, should be carried out prior to filling out the MODCOM input forms.

A. UI/RUM OUTPUT

The course planner may select any period of time in the one- to five-year interval. Longer periods generally help mitigate the effect of large initial investments in hardware and facilities, but they also require more extensive input information. A single UI/RUM run simulates one shift over some period of classroom time. The results are assumed to be extrapolatable to a one-year time period (for that shift). Thus, for a single year's representation, the course planner could have as few as one or as many as four UI/RUM runs in front of him (maximum of four shifts per day). And, if costs are to be estimated for the maximum time span of five years, the course planner could have as many as 20 UI/RUM runs in front of him. However, if time or computer availability constraints prevent making the required number of UI/RUM runs, the analyst can provide his own estimates of resource utilization for unsimulated time spans. It is extremely important, though, that these estimates be consistent for each alternative course design being considered.

For purposes of illustrating the MODCOM input preparation process, the *MODCOM-relevant* portions of UI/RUM output from the maximum load case (16 student entrants every 30 course-hours) have been provided in computer Printouts 1 through 6. Additionally, the UI worksheet for determining specific media systems has also been included (Table 1). Readers having questions concerning the derivation and/or interpretation of Printouts 1 through 6 or Table 1 should consult either Vol. 2 (*Options for Course Design)* or Vol. 4 (*The Resource Utilization Model for Instructional Course Design).*

The values from the maximum load case will be the basis for entries in the third, or peak year, and values from the minimum load case[1] (8 student entrants every 30 course-hours) the basis for the entries in the first (or phase-in) year and fifth (or phase-out) year. Entries for years 2 and 4 will be a linear interpolation of years 1 and 3 and of years 3 and 5, respectively. To simplify this example further, a single-shift operation has been assumed for all years.

B. PREPARING UI/RUM OUTPUT AS MODCOM INPUT

The six MODCOM worksheets, in completed form, are described on the following pages. All values that must be extracted from UI/RUM output are specifically denoted by figure number and alpha designator on that output. The worksheet numbers, titles, and pages on which they are described in detail are as follows:

[1] See Appendix D.

Printout 1

UI Interactive Input: Instructional Policy Definition
for Maximum Load Case

```
**** LENGTH OF THE TRAINING DAY ****
PLEASE ENTER THE LENGTH OF ONE TRAINING SHIFT IN MINUTES?     360 ---- (A)
PLEASE ENTER THE AVERAGE DAILY HOMEWORK REQUIRED IN MINUTES?   60 ---- (B)

**** TRACKING POLICY ****
FOR NEXT QUESTIONS REFER TO
HOW MANY TRACKS ARE IN THE COURSE (2, 3, OR 4)?                 3
PLEASE USE THE CATEGORY ID FROM THE DESCRIPTION OF STUDENT
CATEGORIES ABOVE TO ANSWER THE NEXT FEW QUESTIONS
WHICH STUDENT CATEGORIES ARE IN TRACK 1
? 1
?
WHICH STUDENT CATEGORIES ARE IN TRACK 2
? 3
?
WHICH STUDENT CATEGORIES ARE IN TRACK 3
? 2
? 4
?

**** SUMMARY OF TRACKING DECISIONS ****
TRACK            STUDENT
ID               CATEGORY
1                SLOW NON-E.E.TNG.
2                FAST NON-E.E.TNG.
3                SLOW E.E.TNG.
                 FAST E.E.TNG.
ARE YOU SATISFIED WITH THIS TRACKING POLICY (Y/N)?              Y

**** CONTENT DIVERSIFICATION ****
WILL SLOW NON-E.E.TNG. SKIP ANY CONTENT (Y/N)?                  N
WILL SLOW E.E.TNG. SKIP ANY CONTENT (Y/N)?                      Y
USING THE SECOND EXPANSION OF TRAINING OBJECTIVES ABOVE,
PLEASE ENTER THE SEQUENCE NUMBERS TO BE SKIPPED
? 1
?
WILL FAST NON-E.E.TNG. SKIP ANY CONTENT (Y/N)?                  Y
USING THE SECOND EXPANSION OF TRAINING OBJECTIVES ABOVE,
PLEASE ENTER THE SEQUENCE NUMBERS TO BE SKIPPED
? 13
?
WILL FAST E.E.TNG. SKIP ANY CONTENT (Y/N)?                      Y
USING THE SECOND EXPANSION OF TRAINING OBJECTIVES ABOVE,
PLEASE ENTER THE SEQUENCE NUMBERS TO BE SKIPPED
? 1
? 2
? 13
?
```

Printout 2

UI Interactive Output: Summary of Media Usage
for Maximum Load Case
(Code key appears at end of Printout 2)

TEACHING AGENT & MEDIUM	OBJECTIVE NAME	SUBJECT MATTER	GROUP OR TRACK	LEARNING EVENT TYPE	TEACHING FORMAT	TEACHING AGENT	(A) AVERAGE MINUTES	LEARNING EVENT NUMBER
I.SV	TESTEQP.	1	1	P	R	I	90	1
I.SV	TESTEQP.	2	1	P	R	I	60	3
I.SV	URN5CHAR	2	1	P	R	I	120	5
I.SV	URN5CHAR	6	1	D	GI	I	30	9
I.SV	URN5CHAR	6	2	D	GI	I	24	38
I.SV	URN5CHAR	6	3	D	GI	I	24	64
I.SV	URN5CHAR	6	1	D	GI	I	30	14
I.SV	URN5CHAR	6	2	D	GI	I	24	43
I.SV	URN5CHAR	6	3	D	GI	I	24	69
I.SV	TBSHPRIN	1	1	P	R	I	30	17
I.SV	TBSHPRIN	2	1	P	R	I	60	19
I.SV	FLTCHK..	1	1	P	R	I	30	22
I.SV	INSTALL.	1	1	P	R	I	30	24
I.SV	REVIEW1.	6	1	R	R	I	30	26
I.SV	REVIEW1.	6	3	R	GI	I	30	81
L.ASV	TESTEQP.	1	1	H	RF	L	20	2
L.ASV	TESTEQP.	2	1	H	RF	L	20	4
L.ASV	URN5CHAR	2	1	H	RF	L	20	6
L.ASV	URN5CHAR	6	1	H	RF	L	60	10
L.ASV	URN5CHAR	6	1	H	RF	L	60	15
L.ASV	TBSHPRIN	1	1	H	RF	L	15	13
L.ASV	TBSHPRIN	2	1	H	RF	L	15	20
L.ASV	FLTCHK..	1	1	H	RF	L	15	23
L.ASV	INSTALL.	1	1	H	RF	L	15	25
L.SV	TESTEQP.	1	2	H	AF	L	20	31
L.SV	TESTEQP.	2	2	H	AF	L	20	33
L.SV	TESTEQP.	2	3	H	AF	L	20	59
L.SV	URN5CHAR	2	2	H	AF	L	20	35
L.SV	URN5CHAR	2	3	H	AF	L	20	61
L.SV	URN5CHAR	6	2	GP	AF	L	95	36
L.SV	URN5CHAR	6	2	H	S	L	60	39
L.SV	URN5CHAR	6	3	GP	AF	L	95	62
L.SV	URN5CHAR	6	3	H	S	L	60	65
L.SV	SERVROUT	7	1	UP	S	L	30	11
L.SV	SERVROUT	7	2	UP	S	L	30	40
L.SV	SERVROUT	7	3	UP	S	L	30	66
L.SV	URN5CHAR	6	2	GP	AF	L	95	41
L.SV	URN5CHAR	6	2	H	S	L	60	44
L.SV	URN5CHAR	6	3	GP	AF	L	95	67
L.SV	URN5CHAR	6	3	H	S	L	60	70
L.SV	SERVROUT	7	1	UP	S	L	90	16
L.SV	SERVROUT	7	2	UP	S	L	90	45
L.SV	SERVROUT	7	3	UP	S	L	90	71
L.SV	TBSHPRIN	1	2	H	AF	L	15	47
L.SV	TBSHPRIN	1	3	H	AF	L	15	73
L.SV	TBSHPRIN	2	2	H	AF	L	15	49
L.SV	TBSHPRIN	2	3	H	AF	L	15	75
L.SV	TBSHURN5	7	1	UP	S	L	90	21
L.SV	TBSHURN5	7	2	UP	S	L	90	50
L.SV	TBSHURN5	7	3	UP	S	L	90	76
L.SV	FLTCHK..	1	2	H	AF	L	15	52
L.SV	FLTCHK..	1	3	H	AF	L	15	78
L.SV	INSTALL.	1	2	H	AF	L	15	54
L.SV	INSTALL.	1	3	H	AF	L	15	80
L.SV	EXAM1...	6	1	T	S	L	30	27
L.SV	EXAM1...	6	2	T	S	L	30	55
L.SV	EXAM1...	6	3	T	S	L	30	82
L.SV	EXAM1...	7	1	T	S	L	30	28
L.SV	EXAM1...	7	2	T	S	L	30	56
L.SV	EXAM1...	7	3	T	S	L	30	83

Printout 2 (continued)

TEACHING AGENT & MEDIUM	OBJECTIVE NAME	SUBJECT MATTER	GROUP OR TRACK	LEARNING EVENT TYPE	TEACHING FORMAT	TEACHING AGENT	AVERAGE MINUTES	LEARNING EVENT NUMBER
P.SV	TESTEQP.	1	2	P	AF	AP	67	30
P.SV	TESTEQP.	2	2	P	AF	AP	45	32
P.SV	TESTEQP.	2	3	P	AF	AP	45	58
P.SV	URN5CHAR	2	2	P	AF	AP	89	34
P.SV	URN5CHAR	2	3	P	AF	AP	89	60
P.SV	TBSHPRIN	1	2	P	AF	AP	23	46
P.SV	TBSHPRIN	1	3	P	AF	AP	23	72
P.SV	TBSHPRIN	2	2	P	AF	AP	45	48
P.SV	TBSHPRIN	2	3	P	AF	AP	45	74
P.SV	FLTCHK..	1	2	P	AF	AP	23	51
P.SV	FLTCHK..	1	3	P	AF	AP	23	77
P.SV	INSTALL.	1	2	P	AF	AP	23	53
P.SV	INSTALL.	1	3	P	AF	AP	23	79

KEY TO UI MEDIA USAGE CODES

MEDIUM

AMV	Audio motion visual
ASV	Audio still visual
MV	Motion visual
SV	Still visual
A	Audio
T	Type
AT	Audio plus type

SUBJECT MATTER

1	Easy facts and concepts
2	Difficult facts and concepts
3	Simple classroom skills (selected response)
4	Simple classroom skills (constructed response)
5	Complex classroom skills (selected response)
6	Complex classroom skills (constructed response)
7	Team skills with special resources
8	Individual skills with special resources (product only)
9	Individual skills with special resources (process only)
10	Individual skills with special resources (product and process)

GROUP OR TRACK — User assigned number based on student ability and background

LEARNING EVENT TYPE

P	Presentation or demonstration
GP	Guided practice
UP	Unguided practice
D	Group discussion
CP	Check practice
R	Review
T	Test
C	Critique
H	Homework

TEACHING FORMAT

GI	Group interaction
S	Simple
R	Recitation
RP	Response-paced
AP	Adaptive

TEACHING AGENT

I	Instructor
L	Learner
RP	Response-paced program
AP	Adaptive program

Printout 3

RUM Recap: Summary of Initial Conditions for Maximum Load Case
Resource Utilization Model

```
<-----  SUMMARY  OF  INITIAL  CONDITIONS  ----->
                  --PART1--

REPORTS:  REPORTS WILL BE PRINTED EVERY  768.00 COURSE HOURS.

SIMULATION TERMINATION:  SIMULATION OF THE COURSE WILL TERMINATE AFTER 768.00 COURSE HOURS.


STUDENT ARRIVALS AT COURSE:
     10 STUDENTS WILL ARRIVE AT THE COURSE EVERY   30 COURSE HOURS.
        (B)                                          (C)

STUDENT GROUPING POLICY:

    STUDENTS WILL BE ASSIGNED TO 1 OF 4 CATEGORIES:

   CATEGORY     PERCENT   CATEGORY
   NUMBER       STUDENTS  COMPOSITION
   ------       --------  -----------

     1          .28       SLOW STUDENTS WITHOUT E.E.TNG.
     2          .12       SLOW STUDENTS WITH    E.E.TNG.
     3          .42       FAST STUDENTS WITHOUT E.E.TNG.
     4          .18       FAST STUDENTS WITH    E.E.TNG.


COURSE-FAILURE POLICY:

 85.00 PER CENT OF THE STUDENTS ENTERING THIS COURSE WILL COMPLETE IT SATISFACTORILY.   15.00 PER CENT WILL FAIL.
                                                                                          (A)

STUDENT FAILURES WILL BE RELATED TO STUDENT CATEGORIES AS FOLLOWS:


     50.0 PER CENT OF THE FAILURES WILL BE FROM CATEGORY 1 (WHICH CONTAINS  28.00 PER CENT OF THE STUDENT POPULATION).
     30.0 PER CENT OF THE FAILURES WILL BE FROM CATEGORY 2 (WHICH CONTAINS  12.00 PER CENT OF THE STUDENT POPULATION).
     10.0 PER CENT OF THE FAILURES WILL BE FROM CATEGORY 3 (WHICH CONTAINS  42.00 PER CENT OF THE STUDENT POPULATION).
     10.0 PER CENT OF THE FAILURES WILL BE FROM CATEGORY 4 (WHICH CONTAINS  18.00 PER CENT OF THE STUDENT POPULATION).
```

Printout 4

RUM Output: Information on Graduate and Washout Course Duration for Maximum Load Case

TIME = 768: 0 (HOURS,MINUTES) ------REPORT------ RESOURCE UTILIZATION MODEL

NUMBER OF ARRIVALS	=	416
NUMBER OF GRADUATES	=	320
NUMBER OF FAILURES	=	74
CURRENT NUMBER OF STUDENTS	=	22
AVERAGE TIME BEFORE FAILURE	=	32: 2 ——(B)
CURRENT STUDENTS RECYCLING	=	3
AVERAGE STUDENT LOAD	=	15.8
PEAK STUDENT LOAD	=	24.0
AVERAGE TIME TO FINISH COURSE	=	28:35 ——(A)

<<<< CATEGORIES >>>>

CATEGORY NO.	CUMULATIVE NUMBER OF STUDENTS ARRIVED	/ FAILED	/ GRADUATED	AVERAGE TIME TO FAILURE	/ FINISH COURSE
1	110	33	72	30:54	35:47
2	50	25	20	36:49	37:18
3	184	6	166	23:13	26:26
4	72	10	62	29:17	23: 9

Printout 5

TIME = 768: 0

RUM Output: Resource Utilization by Resource Type for Maximum Load Case

(A) RESOURCE NO.	NAME	QTY.LTD? YES/NO	(B) TOTAL NO. OF UNITS CURRENTLY IN SYSTEM	IN USE	RESERVED	REQUESTED	MAXIMUM NO.OF UNITS CONCURRENTLY IN USE	TOTAL ACTUAL USE HOURS	TOTAL UNIT-HOURS	(C) AVERAGE PER CENT UNIT-HOURS FULLY IDLE
1	ANURNS..	X	5.00	5.00	0.	0.	5.000	876:51	3840: 0	77.16
2	TSNR1...	X	5.00	5.00	0.	0.	5.000	876:51	3840: 0	77.16
3	TSNR2...	X	5.00	5.00	0.	0.	5.000	876:51	3840: 0	77.16
4	SIGGEN..	X	5.00	5.00	0.	0.	5.000	876:51	3840: 0	77.16
5	INSTRCTR	X	3.00	1.13	0.	0.	3.000	837:56	2304: 0	62.47
6	EVALUATR	X	2.00	0.	0.	0.	2.000	106:45	1536: 0	93.05
7	MONITOR2	X	1.00	.17	0.	0.	1.000	275:10	768: 0	30.03
8	MONITOR3	X	1.00	0.	0.	0.	.667	161:56	768: 0	40.92
9	MONITOR.	X	2.00	1.67	-.00	-.00	1.667	247:24	1536: 0	40.53
10	ROOM1...	X	2.00	.33	0.	0.	2.000	629:28	1536: 0	59.32
11	ROOM2...	X	2.00	1.17	-.00	-.00	2.000	332: 4	1536: 0	48.28
12	ROOM3...	X	1.00	0.	-.00	-.00	1.000	231:20	768: 0	31.88
13	LAB.....	X	1.00	.50	0.	0.	.500	84:43	768: 0	64.21
14	I.SV....	X	3.00	1.00	0.	0.	3.000	391:36	2304: 0	83.00
15	L.ASV...	X	8.00	0.	0.	0.	0.	0: 0	6144: 0	100.00
16	L.SV....	X	34.00	12.00	0.	0.	20.000	2903:60	26112: 0	88.87
17	P.SV....	X	12.00	0.	0.	0.	12.000	1445:28	9216: 0	84.31

TIME = 768: 0 (HOURS,MINUTES)

Printout 6

RUM Output: Students and Sections by Learning Event for Maximum Load Case

LE. NO.	OBJECTIVE	EVENT DESCRIPTOR	ELIG. CATE-GORIES	CUMULATIVE STU-DENT ENTRIES	CUMULATIVE SEC-TIONS COMPLTD	CUMULATIVE STU-DENT SKIPS	(A) AVG. NO.OF STDTS	AVERAGE TIME PER STUDENT	MAXIMUM SECTION SIZE ACHIEVED	MAXIMUM NO.OF STDTS.	MAXIMUM NO.OF CONCURRENT SECTIONS	(IF TEST) CUMULATIVE FAILS	(IF TEST) CUMULATIVE RECYCLES	CURRENT STU-DENTS	CURRENT SEC-TION
1	TESTEQP.	PRESENTATION	1	132	33	306	4.26	1:30	6	9	2	0	0	0	0
2	TESTEQP.	HOMEWORK	1	132	132	306	0.	0: 0	1	0	0	0	0	0	0
3	TESTEQP.	PRESENTATION	1	132	33	306	4.26	1: 0	6	9	2	0	0	0	0
4	TESTEQP.	HOMEWORK	1	132	132	306	0.	0: 0	1	0	0	0	0	0	0
5	URNSCHAR	PRESENTATION	1	132	33	306	4.26	2: 0	6	9	2	0	0	0	0
6	URNSCHAR	HOMEWORK	1	132	132	306	0.	0: 0	1	0	0	0	0	0	0
7	URNSCHAR	GUID. PRACT.	1	132	33	306	4.26	1:50	6	9	2	0	0	0	0
8	URNSCHAR	UNGUID.PRACT	1	132	33	306	4.26	3:40	6	9	2	0	0	0	0
9	URNSCHAR	DISCUSSION	1	131	33	306	4.23	0:30	6	9	2	0	0	0	0
10	URNSCHAR	HOMEWORK	1	131	131	306	0.	0: 0	1	0	0	0	0	0	0
11	SERVROUT	UNGUID.PRACT	1	131	31	306	4.23	0:30	8	8	1	0	0	0	0
12	URNSCHAR	GUID. PRACT.	1	131	33	306	4.23	1:50	6	8	2	0	0	0	0
13	URNSCHAR	UNGUID.PRACT	1	131	33	306	4.23	3:40	6	8	2	0	0	0	0
14	URNSCHAR	DISCUSSION	1	131	42	306	3.83	0:30	6	8	2	0	0	0	0
15	URNSCHAR	HOMEWORK	1	131	131	306	0.	0: 0	1	0	0	0	0	0	0
16	SERVROUT	UNGUID.PRACT	1	131	38	306	3.83	1:29	6	8	2	0	0	2	1
17	TBSHPRIN	PRESENTATION	1	129	38	306	3.39	0:30	6	6	1	0	0	0	0
18	TBSHPRIN	HOMEWORK	1	129	129	306	0.	0: 0	1	0	0	0	0	0	0
19	TBSHPRIN	PRESENTATION	1	129	32	306	4.11	1: 0	6	8	2	0	0	0	0
20	TBSHPRIN	HOMEWORK	1	129	129	306	0.	0: 0	1	0	0	0	0	0	0
21	TBSHURN5	UNGUID.PRACT	1	129	38	306	4.04	1:29	6	8	2	0	0	0	0
22	FLTCHK..	PRESENTATION	1	129	35	306	3.96	0:30	6	8	2	0	0	0	0
23	FLTCHK..	HOMEWORK	1	129	129	306	0.	0: 0	1	0	0	0	0	0	0
24	INSTALL.	PRESENTATION	1	129	34	306	3.96	0:30	6	8	2	0	0	0	0
25	INSTALL.	HOMEWORK	1	129	129	306	0.	0: 0	1	0	0	0	0	0	0
26	REVIEW1.	REVIEW	1	129	35	306	3.94	0:30	6	8	2	0	0	0	0
27	EXAM1...	TEST	1	129	31	306	4.16	0:30	6	8	2	0	0	2	1
28	EXAM1...	TEST	1	127	34	306	4.16	0:30	8	8	2	0	0	0	0
29	CRITQ1..	TEST	1	127	32	306	4.23	0:15	6	8	2	33	22	0	0
30	TESTEQP.	PRESENTATION	3	193	193	194	4.99	1: 7	1	11	11	0	0	0	0
31	TESTEQP.	HOMEWORK	3	193	193	194	0.	0: 0	1	0	0	0	0	0	0
32	TESTEQP.	PRESENTATION	3	193	193	194	4.49	0:45	1	11	11	0	0	0	0
33	TESTEQP.	HOMEWORK	3	193	193	194	0.	0: 0	1	0	0	0	0	0	0
34	URNSCHAR	PRESENTATION	3	193	193	194	4.88	1:29	1	11	11	0	0	0	0
35	URNSCHAR	HOMEWORK	3	193	193	194	0.	0: 0	1	0	0	0	0	0	0
36	URNSCHAR	GUID. PRACT.	3	193	193	194	4.87	1:35	1	11	11	0	0	0	0
37	URNSCHAR	UNGUID.PRACT	3	193	193	194	5.08	4:11	1	12	12	0	0	0	0
38	URNSCHAR	DISCUSSION	3	192	55	194	3.92	0:24	6	9	2	0	0	0	0
39	URNSCHAR	HOMEWORK	3	192	192	194	0.	0: 0	1	0	0	0	0	0	0
40	SERVROUT	UNGUID.PRACT	3	192	39	194	4.92	0:30	8	8	1	0	0	0	0
41	URNSCHAR	GUID. PRACT.	3	192	192	194	5.49	1:35	1	11	11	0	0	0	0

TIME = 768: 0 (HOURS,MINUTES)

Printout 6 (continued)

Students and Sections by Learning Event Number

LE. NO.	OBJECTIVE	EVENT DESCRIPTOR	ELIG. CATE-GORIES	CUMULATIVE STU-DENT ENTRIES	CUMULATIVE SEC-TIONS COMPLTD	CUMULATIVE STU-DENT SKIPS	AVG. NO.OF STDTS	AVERAGE TIME PER STUDENT	MAXIMUM SECTION SIZE ACHIEVED	MAXIMUM NO.OF STDTS.	MAXIMUM NO.OF CONCURRENT SECTIONS	(IF TEST) CUMULATIVE FAILS	(IF TEST) CUMULATIVE RECYCLES	CURRENT STU-DENTS	CURRENT SEC-TION
42	URNSCHAR	UNGUID.PRACT	3	192	190	194	6.06	4:11	1	12	12	0	0	2	2
43	URNSCHAR	DISCUSSION	3	190	56	194	4.08	0:24	6	8	2	0	0	2	1
44	URNSCHAR	HOMEWORK	3	188	188	194	0.	0: 0	1	0	0	0	0	0	0
45	SERVROUT	UNGUID.PRACT	3	188	45	194	4.84	1:27	8	10	2	0	0	6	1
46	TBSHPRIN	PRESENTATION	3	182	182	194	4.04	0:23	1	8	8	0	0	0	0
47	TBSHPRIN	HOMEWORK	3	182	182	194	0.	0: 0	1	0	0	0	0	0	0
48	TBSHPRIN	PRESENTATION	3	182	182	194	4.26	0:45	1	10	10	0	0	0	0
49	TBSHPRIN	HOMEWORK	3	182	182	194	0.	0: 0	1	0	0	0	0	0	0
50	TBSHURNS	UNGUID.PRACT	3	182	46	194	5.06	1:26	8	10	3	0	0	0	0
51	FLTCHK..	PRESENTATION	3	182	182	194	3.98	0:23	1	10	10	0	0	0	0
52	FLTCHK..	HOMEWORK	3	182	182	194	0.	0: 0	1	0	0	0	0	0	0
53	INSTALL.	PRESENTATION	3	182	182	194	3.92	0:23	1	10	10	0	0	0	0
54	INSTALL.	HOMEWORK	3	182	182	194	0.	0: 0	1	0	0	0	0	0	0
55	EXAM1...	TEST	3	182	182	194	4.18	0:30	1	12	12	0	0	0	0
56	EXAM1...	TEST	3	182	48	194	4.13	0:30	8	8	2	0	0	0	0
57	CRITQ1..	TEST	3	181	49	194	3.95	0:15	6	8	2	6	9	0	0
58	TESTEQP.	PRESENTATION	2	51	51	311	1.82	0:45	1	4	4	0	0	0	0
59	TESTEQP.	HOMEWORK	2	51	51	311	0.	0: 0	1	0	0	0	0	0	0
60	URNSCHAR	PRESENTATION	2 4	124	124	238	2.96	1:29	1	8	8	0	0	0	0
61	URNSCHAR	HOMEWORK	2 4	124	124	238	0.	0: 0	1	0	0	0	0	0	0
62	URNSCHAR	GUID. PRACT.	2 4	124	124	238	3.03	1:35	1	8	8	0	0	0	0
63	URNSCHAR	UNGUID.PRACT	2 4	124	124	238	3.77	4:11	1	8	8	0	0	0	0
64	URNSCHAR	DISCUSSION	2 4	124	58	238	2.14	0:24	3	3	1	0	0	0	0
65	URNSCHAR	HOMEWORK	2 4	124	124	238	0.	0: 0	1	0	0	0	0	0	0
66	SERVROUT	UNGUID.PRACT	2 4	124	36	238	3.44	0:30	5	5	1	0	0	0	0
67	URNSCHAR	GUID. PRACT.	2 4	124	124	238	4.39	1:35	1	8	8	0	0	0	0
68	URNSCHAR	UNGUID.PRACT	2 4	124	124	238	4.73	4:11	1	8	8	0	0	0	0
69	URNSCHAR	DISCUSSION	2 4	124	58	238	2.14	0:24	3	3	1	0	0	0	0
70	URNSCHAR	HOMEWORK	2 4	124	124	238	0.	0: 0	1	0	0	0	0	0	0
71	SERVROUT	UNGUID.PRACT	2 4	124	29	238	4.17	1:30	8	8	2	0	0	2	1
72	TBSHPRIN	PRESENTATION	2 4	122	122	238	4.21	0:23	1	8	8	0	0	0	0
73	TBSHPRIN	HOMEWORK	2 4	122	122	238	0.	0: 0	1	0	0	0	0	0	0
74	TBSHPRIN	PRESENTATION	2 4	122	122	238	4.21	0:45	1	8	8	0	0	0	0
75	TBSHPRIN	HOMEWORK	2 4	122	122	238	0.	0: 0	1	0	0	0	0	0	0
76	TBSHURNS	UNGUID.PRACT	2 4	121	38	238	3.91	1:30	5	8	2	0	0	0	0
77	FLTCHK..	PRESENTATION	2 4	121	121	238	3.27	0:23	1	7	7	0	0	0	0
78	FLTCHK..	HOMEWORK	2 4	121	121	238	0.	0: 0	1	0	0	0	0	0	0
79	INSTALL.	PRESENTATION	2 4	121	121	238	3.27	0:23	1	7	7	0	0	0	0
80	INSTALL.	HOMEWORK	2 4	121	121	238	0.	0: 0	1	0	0	0	0	0	0
81	REVIEW1.	REVIEW	2	47	23	311	2.04	0:30	3	3	1	0	0	0	0
82	EXAM1...	TEST	2 4	120	120	238	2.37	0:30	1	6	6	0	0	0	0
83	EXAM1...	TEST	2 4	120	45	238	2.76	0:30	6	6	2	0	0	0	0
84	CRITQ1..	TEST	2 4	119	46	238	2.59	0:15	6	6	1	35	2	0	0

Table 1
UI Worksheet for Maximum Load Case

Output from User Interface									Output from HUM			User Decision	HUM Output
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Teaching Agent & Medium	Objective	Subject Matter	Group or Track	Learning Event Type	Teaching Format	Teaching Agent	Average Minutes	Learning Event Number	Maximum Section Size Achieved	Maximum No. of Concurrent Sections	Maximum No. of Students	Specific Media Systems	Total Units Concurrently in System
I.SV	TESTEQP	1	1	P	R	I	90	1	6	2	9	Overhead projector	3
	"	2	1	P	R	I	60	3	6	2	9	"	3
	URH5CHAR	2	1	P	R	I	120	5	6	2	9	"	3
	"	6	1	D	GI	I	30	9	6	2	9	"	3
	"	6	2	D	GI	I	24	38	6	2	9	"	3
	"	6	3	D	GI	I	24	64	3	1	3	"	3
	"	6	1	D	GI	I	30	14	6	2	8	"	3
	"	6	2	D	GI	I	24	43	6	2	8	"	3
	"	6	3	D	GI	I	24	69	3	1	3	"	3
	TRSHPRIN	1	1	P	R	I	30	17	6	1	6	"	3
	"	2	1	P	R	I	60	19	6	2	8	"	3
	FLTCHK	1	1	P	R	I	30	22	6	2	8	"	3
	INSTALL	1	1	P	R	I	30	24	6	2	8	"	3
	REVIEW1	6	1	R	R	I	30	26	6	2	8	"	3
	"	6	3	R	GI	I	30	81	3	1	3	"	3
L.ASV	TESTEQP	1	1	H	RF	L	20	2	1	0	0	ASV teaching machine[a]	9
	"	2	1	H	RF	L	20	4	1	0	0	"	9
	URH5CHAR	2	1	H	RF	L	20	6	1	0	0	"	9
	"	6	1	H	RF	L	60	10	1	0	0	"	9
	"	6	1	H	RF	L	60	15	1	0	0	"	9
	TRSHPRIN	1	1	H	RF	L	15	18	1	0	0	"	9
	"	2	1	H	RF	L	15	20	1	0	0	"	9
	FLTCHK	1	1	H	RF	L	15	23	1	0	0	"	9
	INSTALL	1	1	H	RF	L	15	25	1	0	0	"	9
L.SV	TESTEQP	1	2	H	AF	L	30	31	1	0	0	Programmed text	
	"	2	2	H	AF	L	20	33	1	0	0	"	
	"	2	3	H	AF	L	20	39	1	0	0	"	
	URH5CHAR	2	2	H	AF	L	20	35	1	0	0	"	
	"	2	3	H	AF	L	20	61	1	0	0	"	
	"	6	2	GP	AF	L	95	36	1	11	11	"	
	"	6	2	H	S	L	60	39	1	0	0		
	"	6	3	GP	AF	L	95	62	1	8	8	"	
	"	6	3	H	S	L	60	65	1	0	0		
	SERVOUT	7	1	UP	S	L	30	11	8	1	8		
	"	7	2	UP	S	L	30	40	8	1	8		
	"	7	3	UP	S	L	30	66	5	1	5		
	URH5CHAR	6	2	GP	AF	L	95	41	1	11	11	"	
	"	6	2	H	S	L	60	44	1	0	0		
	"	6	3	GP	AF	L	95	67	1	8	8	"	
	"	6	3	H	S	L	60	70	1	0	0		
	SERVOUT	7	1	UP	S	L	90	16	6	2	8		
	"	7	2	UP	S	L	90	45	8	2	10		
	"	7	3	UP	S	L	90	71	8	2	8		
	TRSHPRIN	1	2	H	AF	L	15	47	1	0	0	"	
	"	1	3	H	AF	L	15	73	1	0	0	"	
	"	2	2	H	AF	L	15	49	1	0	0	"	
	"	2	3	H	AF	L	15	75	1	0	0		
	TRSHURH5	7	1	UP	S	L	90	21	6	2	8		
	"	7	2	UP	S	L	90	50	8	3	10		
	"	7	3	UP	S	L	90	76	5	2	8		
	FLTCHK	1	2	H	AF	L	15	52	1	0	0	"	
	"	1	3	H	AF	L	15	78	1	0	0	"	
	INSTALL	1	2	H	AF	L	15	54	1	0	0	"	
	"	1	3	H	AF	L	15	80	1	0	0	"	
	EXAM1	6	1	T	S	L	30	27	6	2	8		
	"	6	2	T	S	L	30	55	1	12	12		
	"	6	3	T	S	L	30	82	1	6	6		
	"	7	1	T	S	L	30	28	8	2	8		
	"	7	2	T	S	L	30	56	8	2	8		
	"	7	3	T	S	L	30	83	6	2	6		
P.SV	TESTEQP	1	2	P	AF	AP	67	30	1	11	11	SV teaching machine (filmstrip)	12
	"	2	2	P	AF	AP	45	32	1	11	11	"	12
	"	2	3	P	AF	AP	45	58	1	4	4	"	12
	URH5CHAR	2	2	P	AF	AP	89	34	1	11	11	"	12
	"	2	3	P	AF	AP	89	60	1	8	8	"	12
	TRSHPRIN	1	2	P	AF	AP	23	46	1	8	8	"	12
	"	1	3	P	AF	AP	23	72	1	8	8	"	12
	"	2	2	P	AF	AP	45	48	1	10	10	"	12
	"	2	3	P	AF	AP	45	74	1	8	8	"	12
	FLTCHK	1	2	P	AF	AP	23	51	1	10	10	"	12
	"	1	3	P	AF	AP	23	77	1	7	7	"	12
	INSTALL	1	2	P	AF	AP	23	53	1	10	10	"	12
	"	1	3	P	AF	AP	23	79	1	7	7	"	12

[a] Filmstrip and audiotape cassette.

MODCOM Worksheet		*Page*
1	Course Duration and Student Entrants	24
2	Instructor Requirements	25
3	Single-Shift Courseware Requirements	25
4	Total Courseware Requirements	31
5	Hardware Requirements	33
6	Facility Requirements	34

Items in italics on the worksheets represent entries that would normally be made by the course planner (i.e., handwritten).

MODCOM Worksheet 1: Course Duration and Student Entrants

Classroom Training Hours per Student per Day. This value can be determined by dividing the UI input "length of one training shift" (see Printout 1, [A]) by 60.

Average Course Duration per Graduate (in hours). This value is simply the RUM output "average time to finish course" (see Printout 4, [A]) rounded to the nearest hour. If the average time to finish varies between UI/RUM runs, then the value entered should be the weighted average (weighted by annual student graduates) for the entire time span.

MODCOM Worksheet 1

Course Duration and Student Entrants

Classroom training hours per student per day	=	*6.0*
Average course duration per graduate (in hours)	=	*30*[a]
Washout rate (percent)	=	*15*
Average course duration per washout (in hours)	=	*31*[a]
Entry interval (in hours)	=	*30*

Student Entrants

Shift	Number of Entrants in Year Z				
	Z=1	Z=2	Z=3	Z=4	Z=5
1	*403*	*604*	*806*	*604*	*403*
2					
3					
4					
Total, all shifts	*403*	*604*	*806*	*604*	*403*

[a]Weighted average of five-year span.

Washout Rate (percent). This value should coincide with the value input as part of the UI's[2] course failure policy (see Printout 3, [A]).

Average Course Duration per Washout (in hours). The value entered in this space should be the RUM output "average time before failure" (see Printout 4, [B]) rounded to the nearest hour. If the average time before failure varies between UI/RUM runs, then the value entered should be the weighted average (weighted by annual student failures) for the entire time span.

Entry Interval (in hours). This value should agree with the value entered as part of the UI's[2] student arrival rate (see Printout 3, [C]).

Number of Student Entrants. The number of annual student entrants can be determined by multiplying the UI input[2] for student arrivals (see Printout 3, [B]) by the number of classroom training hours per student per year[3] and then dividing the product by the UI input for the entry interval. If multishift operations are in effect, the number of students should be summed over all shifts.

MODCOM Worksheet 2: Instructor Requirements

The RUM output listing resource utilization by resource type (see Printout 5, [A]) may identify several different types of instructors, among them academic, remedial, and special requirements instructors as well as course monitors and supervisors. For instructors dedicated to the subject course (that is, instructors teaching only that course), the number of instructor man-years equals the "total number of units currently in system" (see Printout 5, [B]). For those instructors shared among several courses (e.g., supervisors), the number of instructor man-years can be derived utilizing "average percent unit-hours fully idle" (see Printout 5, [C]):

$$\text{Instructor man-years} = \text{total number of units currently in system} * (1 - \text{average percent unit-hours fully idle} \div 100)$$

For multishift operations, the total number of instructor man-years for a given type of instructor may be found by summing over all shifts.

Personnel identified in the MODIA sample case and entered on this worksheet include academic instructors, lab monitors, room monitors, and evaluators. Only 7 percent of the evaluator's time is charged to the course since evaluators are assumed to be shared among several courses.

MODCOM Worksheet 3: Single Shift Courseware Requirements

The determination of specific courseware requirements (program length and number of copies) is a subjective process which depends significantly on the expertise of the course planner. Logically, it is an extension of the media system selection process performed during iteration of the UI/RUM. The following paragraphs

[2] These values, which appear as RUM recap, are actually input by the planner through the User Interface.

[3] The number of classroom training hours per student per year equals the number of classroom training hours per student per day multiplied by the number of training days per month multiplied by 12 months per year. This value is normally 1511 or 6 * 20.99 * 12. (Throughout the report, an asterisk will be used to indicate multiplication.)

MODCOM Worksheet 2

Instructor Requirements

Instructor Type	Shift	Number of Instructor Man-Years in Year Z				
		Z=1	Z=2	Z=3	Z=4	Z=5
Academic instructors	1	2	2.5	3	2.5	2
	2					
	3					
	4					
	Total	2	2.5	3	2.5	2
Lab monitors	1	2	2	2	2	2
	2					
	3					
	4					
	Total	2	2	2	2	2
Room monitors	1	2	2	2	2	2
	2					
	3					
	4					
	Total	2	2	2	2	2
Evaluators	1	.07	.10	.14	.10	.07
	2					
	3					
	4					
	Total	.07	.10	.14	.10	.07
	1					
	2					
	3					
	4					
	Total					
	1					
	2					
	3					
	4					
	Total					

MODCOM Worksheet 3

Single Shift Courseware Requirements, Maximum Load Case

← IT Worksheet for Medium System Selection →

← MODCOM Worksheet for Single-shift Courseware Requirements →

Output from User Interface									Output from MMI			User Decision	MMI Output	User Definition			
(1) Teaching Agent & Medium	(2) Objective	(3) Subject Matter	(4) Group or Track	(5) Learning Event Type	(6) Teaching Format	(7) Teaching Agent	(8) Average Minutes	(9) Learning Event Number	(10) Maximum Section Size Achieved	(11) Maximum No. of Concurrent Sections	(12) Maximum No. of Students	(13) Specific Units System	(14) Total Units Concurrently in System	(15) Check If Distinct Program	(16) Presentation Time in Minutes	(17) Name (reels, cards, books) & No. of Courseware Copies Required (Should not include master, which is never used in class)	(18) Name (minutes, slides, pages) & Number of Courseware Weapons
I.SV	TESTSUP	1	1	P	B	I	90	1	0	0	0	Overhead projector	3	✓	60	2 sets	45 transparencies
	"	2	1	P	B	I	60	3	0	0	0	"	3	✓	60	2 "	30 "
	UNSCHAR	2	1	P	R	I	120	5	0	0	0	"	3	✓	60	2 "	60 "
	"	6	1	D	G1	I	30	9	0	0	0	"	3	✓	120	2 "	60 "
	"	6	2	D	G1	I	24	38	0	0	0	"	3	✓	30	2 "	6 "
	"	6	3	D	G1	I	24	64	3	1	3	"	3				
	"	6	1	D	G1	I	30	14	0	0	0	"	3				
	"	6	2	D	G1	I	24	43	0	0	0	"	3	✓	30	2 "	6 "
	"	6	3	D	G1	I	24	69	3	1	3	"	3				
	TRUPRIN	1	1	P	R	I	30	17	0	0	0	"	3				
	"	2	1	P	R	I	60	19	0	0	0	"	3	✓	30	1 "	15 "
	FLTCHK	1	1	P	R	I	30	22	0	0	0	"	3	✓	60	2 "	30 "
	INSTALL	1	1	P	R	I	30	24	0	0	0	"	3	✓	60	2 "	30 "
	REVIEW1	6	1	R	R	I	30	27	0	0	0	"	3	✓	30	2 "	15 "
	"	6	3	R	G1	I	30	67	3	1	3	"	3	✓	30	2 "	6 "
I.ASV	TESTSUP	1	1	D	AV	L	20	2	1	0	0	ASV teaching machine*	9	✓	17.5	0 filmstrips, 0 audiocassettes	17.5 frames, 17.5 minutes
	"	2	1	R	AV	L	20	6	1	0	0	"	9	✓	17.5	0 " 0 "	17.5 " 17.5 "
	UNSCHAR	2	1	R	AV	L	20	6	1	0	0	"	9	✓	17.5	0 " 0 "	17.5 " 17.5 "
	"	6	1	R	AV	L	60	10	1	0	0	"	9	✓	17.5	0 " 0 "	17.5 " 17.5 "
	"	6	1	R	AV	L	60	13	1	0	0	"	9	✓	43.5	0 " 0 "	43.5 " 43.5 "
	TRUPRIN	1	1	R	AV	L	15	10	1	0	0	"	9	✓	43.5	0 " 0 "	43.5 " 43.5 "
	"	2	1	R	AV	L	15	20	1	0	0	"	9	✓	43.5	0 " 0 "	43.5 " 43.5 "
	FLTCHK	1	1	R	AV	L	15	23	1	0	0	"	9	✓	15.125	0 " 0 "	15.125 " 15.125 "
	INSTALL	1	1	R	AV	L	15	25	1	0	0	"	9	✓	15.125	0 " 0 "	15.125 " 15.125 "
	"											"	9	✓	15.125	0 " 0 "	15.125 " 15.125 "
I.SV	TESTSUP	1	2	R	AV	L	20	31	1	0	0	Printed text		✓	20	texts	60 pages
	"	2	2	R	AV	L	20	33	1	0	0	"		✓	30	"	60 "
	UNSCHAR	2	2	R	AV	L	20	30	1	0	0	"					30 "
	"	2	3	R	AV	L	20	35	1	0	0	"		✓	30	"	60 "
	"	6	2	G	AV	L	90	36	11	11	11	"		✓	30	"	120 "
	"	6	2	R	R	L	60	39	1	0	0	"					
	"	6	3	G	AV	L	90	62	1	0	0	"					
	"	6	3	R	R	L	60	65	1	0	0						
	SERVOUT	7	1	G	R	L	30	11	0	0	0						
	"	7	2	G	R	L	30	40	0	0	0						
	"	7	3	G	R	L	30	66	0	0	0						
	UNSCHAR	6	2	G	AV	L	90	41	1	11	11	"		✓	30	"	120 "
	"	6	2	R	R	L	60	44	1	0	0	"					
	"	6	3	G	AV	L	90	67	1	0	0	"					
	"	6	3	R	R	L	60	70	1	0	0						
	SERVOUT	7	1	G	R	L	90	58	0	2	0						
	"	7	2	G	R	L	90	63	0	2	10						
	"	7	3	G	R	L	90	71	0	2	9						
	TRUPRIN	1	3	R	AV	L	15	47	1	0	0	"					
	"	1	3	R	AV	L	15	73	1	0	0	"		✓	15	"	60 "
	"	2	2	R	AV	L	15	49	1	0	0			✓	15	"	60 "
	"	2	3	R	AV	L	15	75	1	0	0						
	TSUNMS	7	1	G	R	L	90	51	0	2	0						
	"	7	2	G	R	L	90	56	0	2	10						
	"	7	3	G	R	L	90	78	0	2	9						
	FLTCHK	1	2	R	AV	L	15	52	1	0	0	"					
	"	1	3	R	AV	L	15	78	1	0	0	"		✓	15	"	60 "
	INSTALL	1	2	R	AV	L	15	54	1	0	0	"		✓	15	"	60 "
	"	1	3	R	AV	L	15	80	1	0	0	"					
	EXAM1	6	1	T	R	L	30	27	0	2	0						
	"	6	2	T	R	L	30	33	1	11	11						
	"	6	3	T	R	L	30	81	1	6	6						
	"	7	1	T	R	L	30	28	0	2	0						
	"	7	2	T	R	L	30	34	0	2	0						
	"	7	3	T	R	L	30	85	0	2	0						
P.SV	TESTSUP	1	2	P	AV	AV	67	30	1	11	11	SV teaching machine (filmstrip)					
	"	2	2	P	AV	AV	45	31	1	11	11	"	13	✓	60	11 filmstrip cartridges	30 frames
	UNSCHAR	2	2	P	AV	AV	45	36	1	4	4	"	13	✓	30	11 " "	30 "
	"	2	3	P	AV	AV	89	86	1	11	11	"	13				
	TRUPRIN	1	2	P	AV	AV	23	46	1	8	8	"	13	✓	70	11 " "	70 "
	"	1	3	P	AV	AV	23	72	1	8	8	"	13	✓	30	11 " "	30 "
	"	2	3	P	AV	AV	45	48	1	10	10	"	13	✓	30	11 " "	30 "
	FLTCHK	1	2	P	AV	AV	45	74	1	8	8	"	13				
	"	1	3	P	AV	AV	23	51	1	10	10	"	13	✓	30	11 " "	30 "
	INSTALL	1	2	P	AV	AV	23	77	1	7	7	"	13				
	"	1	3	P	AV	AV	23	79	1	10	10	"	13	✓	30	11 " "	30 "
									1	7	7	"	13				
												Technical orders				5 sets	1200 pages
												Study references				sets	45 "
												Lesson plans				sets	30 "

*Filmstrip and audiotape cassette.

describe the steps necessary to determine courseware requirements beginning with a recapitulation of the previously executed media system selection.

The UI Manual[4] discusses the selection of specific media systems (hardware/courseware combinations) on the basis of initial UI/RUM runs. As part of that selection process, a UI worksheet was prepared for the maximum load case and has been included as Table 1. Six teaching agent/media/teaching format combinations are listed—still visual media supporting instructor presentation (I.SV) in recitation and group interaction format; audio still visual media supporting the learner (L.ASV) in a response-paced format; still visual media supporting the learner (L.SV) in simple and adaptive format; and still visual media supporting an adaptive program (P.SV) in an adaptive format.

During preliminary runs of the RUM, media systems were chosen for each teaching agent/media/teaching format combination. An overhead projector for small-group instruction was chosen for the I.SV media; an audio still visual teaching machine with a combination of filmstrips and audiotape cassettes for the L.ASV media; a programmed text for the L.SV media in adaptive format; and a still visual teaching machine using filmstrip cartridges for the P.SV media. Most of the L.SV media in simple format support learner performance in a team situation (subject matter type 7) and are, in fact, the technical orders normally used with the AN/URN-5 low frequency beacon. No courseware needs to be developed or produced for this. As a result, the tech orders are listed as a single item at the conclusion of the worksheet. The remaining L.SV media in simple format represent exams and homework which require so little in terms of development and reproduction that they are ignored in this example.

Although the foregoing analysis accounts for all of the media explicitly assigned in the UI, note that study references have been added. This was done so that each student would have materials to study on his own if he felt he needed them. A set of lesson plans for instructors was also added.

The determination of specific courseware requirements requires a further extrapolation of the UI worksheet. To illustrate, the UI worksheet has been combined with MODCOM Worksheet 3. Worksheet 3 assists the planner in determining the single shift courseware requirements for a single year.

Distinct Program Designation. The first step is to decide which learning events will use distinct courseware; these should then be designated by check marks in column 15. If a particular type of courseware can be used for more than one learning event, only one of the events needs the distinct program designation. There are no absolute rules for this procedure, which is heavily dependent on the course planner's expertise. Generally, however, if a particular courseware is to be used for more than one learning event, the learning events will have the same objective and subject matter.

In the example, the instructor can adapt the I.SV media to student needs (through delivery modification); all tracks of the same learning event type can thus use the same basic courseware. Therefore, no checks are entered for learning events 38, 64, 43, 69, and 81. On the other hand, the L.ASV media are used only for a single track, so each learning event will require a distinct program. The L.SV media in adaptive format are homework and guided practice prepared for tracks

[4] See *MODIA: Vol. 2, Options for Course Design*, R-1701-AF, pp. 84-90.

2 and 3, and it is assumed that whenever both tracks are for the same type of learning event they can use the same courseware program because of the adaptive format. The P.SV media are also prepared for tracks 2 and 3, and it is assumed that a single courseware program can serve both, again because of the adaptive format.

Actual Presentation Minutes. The number of actual presentation minutes is entered in column 16 for each event checked in column 15. Actual presentation minutes equal "average minutes" (column 8) less nonpresentation activity minutes. Actual presentation time is time occupied by formal media presentation and does not include time spent for student/instructor dialogue, group discussion, student response, and the like. For example, if the purpose of a film is to stimulate group discussion, then the film run time (the actual presentation minutes) would occupy only some fraction of total learning-event time ("average minutes"). Again, the determination of this value depends significantly on the expertise of the course planner.

In the MODIA sample case, actual presentation time for the I.SV media was taken to be the same as the length of the learning event except for the group discussion sessions (learning events 9 and 14) to which only 10 minutes were allocated for media presentation. Since it should take relatively little time for the learner to respond to the questions of the audio still visual teaching machine, we estimated that 7/8 of the time allotted for these learning events (I.ASV media) would be actual presentation time. For most of the programmed-text events (I.SV in adaptive format), actual presentation time equals average learning-event time because the learner works with the text throughout the learning event. The exceptions are the guided-practice events that require a significant amount of student response; here actual presentation time was reduced to 30 minutes. The actual presentation time for each P.SV event is taken as 7/8 of the average learning-event time, the same as for the audio still visual teaching machine.

Name and Number of Courseware Copies. The next step is to enter in column 17 the name (reels, sets, books) and number of courseware copies required. Table 2 provides examples of UI/RUM-MODCOM conversions for some of the most frequently used courseware types. For the sample case, sets (or transparencies) are used for the overhead projector; filmstrips and audio tape cassettes for the audio still visual teaching machines; texts for the programmed texts; and filmstrip cassettes for the still visual teaching machines. For display media and software used in classroom sessions, the number of copies required equals the "maximum number of concurrent sections" (column 11). Where more than one section uses the same courseware, however, the number of copies required is the *minimum* of: the *sum* of the "maximum number of concurrent sections" for all sections using the courseware type *and* the "total number of units (of the relevant media system) currently in the system" (column 14). For example, since the number of overhead projectors in the system is three, the maximum number of transparency sets is never more than three. A similar process is used to determine the number of filmstrip cassettes required for learning events that use the still visual teaching machines.

For display media and software used in homework events (note that the "maximum number of concurrent sections" is shown as 0 for these events), the number of copies required equals the "maximum number of students" (column 12) in the learning event that immediately precedes the homework event (since each student will require a copy of the courseware).

Table 2

UI-RUM and MODCOM Exemplary Courseware Conversion Table

UI and HUM Medium Types	Specific Courseware Type	Cost Model Class	Possible Courseware Copies	Possible Courseware Measures	Typical Number of Measures per Minute of Presentation[a]
Audio motion visual (AMV)	Videotape	Display media	Cassette	Minutes	1
	Sound film	Display media	Reel	Minutes	1
	Television (live transmission)	Display media	Program	Minutes	1
Audio still visual (ASV)	(b)				
Motion visual (MV)	Silent film	Display media	Cartridge	Minutes	1
Still visual (SV)	Filmstrip	Display media	Roll	Frames	.017 to 3.0
	Slide	Display media	Set	Slides	.017 to 3.0
	Transparency	Display media	Set	Transparencies	.017 to 3.0
	Textbook	Printed media	Book	Pages	.017 to 1.0
	Workbook	Printed media	Book	Pages	.017 to 1.0
	Programmed text[c]	Printed media	Book	Pages	.03 to 2.0
	Programmed text[d]	Printed media	Book	Pages	.05 to 5.0
	Manual, technical order	Printed media	Manual	Pages	.017 to 1.0
	Chart, map	Display media	Set	Charts, maps	Indefinite
Audio (A)	Audio disc	Display media	Record	Minutes	1
	Audio tape	Display media	Cassette	Minutes	1
	Radio (live transmission)	Display media	Cassette	Minutes	1
Type (T)	Computer program	Software	Program	Instructions	.5 to 1.0[e]

[a] Presentation time is time occupied by formal media presentation; it does not include time spent in student-instructor dialogue, group discussion, student response, and the like.

[b] See audio and still visual components.

[c] In recitation (or linear) format.

[d] In adaptive (or branching) format.

[e] When accompanied by visual material, the number of instructions per minute equals .5; when unaccompanied, 1.

For printed media which are distributed to all students and instructors or to instructors only, column 17 *may* be left blank, since MODCOM provides an option for internally calculating the copies required for both cases.[9] For all other printed media, such as remedial workbooks, where some *subset* of the student and instructor population is involved, the course planner must make his own estimate of copies required. In the example, MODCOM makes computations of copies of all printed media even though students in track 1 do not use programmed texts. This was done because the cost of reproducing printed media is so relatively small that this overestimate will have a negligible effect on total course costs.

[9] Printed media consists of texts, workbooks, lesson and evaluation guides, technical orders, and reference manuals. A complete set of texts and workbooks is provided to each student when he enters the course, and they are his to keep when he leaves. Each instructor and course supervisor is also given a complete set ot texts and workbooks as well as any required lesson and evaluation guides, and they are also his to keep when his tour of duty as an instructor is complete. Thus, the number of textbooks and workbooks required in each subsequent year is equal to the number of student entrants plus the instructor turnover plus any increases in the instructor force. The number of lesson and evaluation guides required in each subsequent year is equal to the instructor turnover plus any increases in the instructor force.

Note that the number of sets of technical orders required equals the number of sets of equipment that they are used with: one set of tech orders per set of equipment.

Name and Number of Courseware Measures. Finally, the name and number of courseware measures per copy are entered in column 18. Table 2 provides possible courseware measure names: transparencies for overhead projectors, frames for filmstrips, minutes for audiotape cassettes, and pages for programmed texts and study references. Table 2 also provides rules-of-thumb for determining the number of courseware measures per minute of presentation.

For the sample case, the number of transparencies to support the instructor-delivered talk was determined by dividing the number of minutes in the talk by two (the approximate midpoint in the range shown in Table 2). Since teaching machine programs do not need to allow time for the speaker to add personal comments, an estimate of one frame per minute will be used for the audio still visual teaching machine. The number of minutes of tape required is, of course, the same as the actual presentation minutes. Where the adaptive format is used, the number of pages of programmed text is taken to be four times the number of presentation minutes. This gives leeway for the branching program required for the adaptive format. The number of frames required for the still visual teaching machine is estimated in the same way as for the audio still visual teaching machine.

MODCOM Worksheet 4: Total Courseware Requirements

Worksheet 3 assists the course planner in determining the number of copies of each courseware type required for a single shift of a single year. Worksheet 4 provides a format for: 1) collecting the number of copies of each courseware type required for all shifts of all years; and 2) grouping the courseware so as to reduce the number of separate entries.

Courseware Copy Requirements. As mentioned previously (p. 30), copy requirements for printed media distributed to all instructors or to all students and instructors may be calculated automatically within MODCOM. However, total annual copy requirements for printed media distributed to some subset of the student and/or instructor population (such as remedial texts) are determined by *summing* over all shifts. Total annual copy requirements for undistributed printed media (such as reference manuals) are found by taking the *maximum* of the individual shift values.

For the display media and software classes of courseware, the total number of copies required each year equals the *maximum* of the individual shift values.

Courseware Grouping. The foregoing analysis (Worksheet 3 and the initial columns of Worksheet 4) suggests that there will probably be many entries on Worksheet 4. The MODIA sample case, a relatively short example, has 38; a course of average length could well have several times that number. There is no need, however, to make a separate entry for every courseware package, as courseware can be aggregated to reduce input requirements. The simplest way to do this is to make only one entry for each courseware group that requires the same number of copies for each level of student load. For example, in the MODIA sample case, the ten transparency sets have been reduced to three packages: one for learning events requiring one copy at the minimum load and one at the maximum load; one for

MODCOM Worksheet 4

Total Courseware Requirements

Type of Courseware	Learning Event Number	Name and Number of Courseware Measure	Name of Copies	No. of Copies of Courseware Required in Year Z[a,b] Z=1	Z=2	Z=3	Z=4	Z=5	Grouping: Designator	Grouping: Number of Measures per Package	Grouping: Packaging Factor
Transparencies	1	45 *transparencies*	*Sets*	1	2	2	2	1	A	A: 195 *transparencies*	6
	3	30 "	"	1	2	2	2	1	A		
	5	60 "	"	1	2	2	2	1	A		
	9	5 "	"	2	3	3	3	2	B	B: 15 *transparencies*	3
	43	5 "	"	2	3	3	3	2	B		
	17	15 "	"	1	1	1	1	1	C	C: 15 *transparencies*	1
	19	30 "	"	1	2	2	2	1	A		
	22	15 "	"	1	2	2	2	1	A		
	24	15 "	"	1	2	2	2	1	A		
	26	5 "	"	2	3	3	3	2	B		
Filmstrips	2	17.5 *frames*	*Filmstrips*	5	7	9	7	5	D	D: 105 *frames*	4
	4	17.5 "	"	5	7	9	7	5	D		
	6	17.5 "	"	5	7	9	7	5	D		
	10	52.5 "	"	5	7	9	7	5	D		
	15	52.5 "	"	5	7	8	7	5	E	E: 13 *frames*	1
	18	13.125 "	"	4	5	6	5	4	F	F: 13 *frames*	1
	20	13.125 "	"	6	7	8	7	6	G	G: 53 *frames*	3
	23	13.125 "	"	6	7	8	7	6	G		
	25	13.125 "	"	6	7	8	7	6	G		
Audiotape cassettes	2	17.5 *minutes*	*Audio-cassettes*	5	7	9	7	5	H	H: 105 *minutes*	4
	4	17.5 "	"	5	7	9	7	5	H		
	6	17.5 "	"	5	7	9	7	5	H		
	10	52.5 "	"	5	7	9	7	5	H		
	15	52.5 "	"	5	7	8	7	5	I	I: 13 *minutes*	1
	18	13.125 "	"	4	5	6	5	4	J	J: 13 *minutes*	1
	20	13.125 "	"	6	7	8	7	6	K	K: 53 *minutes*	3
	23	13.125 "	"	6	7	8	7	6	K		
	25	13.125 "	"	6	7	8	7	6	K		
Programmed texts	(31,33,35, 41,47,49, 52,54)	720 *pages*	*Texts*	-	-	-	-	-	L	L: 720 *pages*	1
Filmstrip cartridges	30	59 *frames*	*Filmstrip cartridges*	6	9	11	9	6	M	M: 59 *frames*	1
	32	39 "	"	8	10	12	10	8	N	N: 216 *frames*	6
	34	78 "	"	8	10	12	10	8	N		
	46	20 "	"	8	10	12	10	8	N		
	48	39 "	"	8	10	12	10	8	N		
	51	20 "	"	8	10	12	10	8	N		
	53	20 "	"	8	10	12	10	8	N		
Technical orders	-	- -	*Sets*	4	5	5	5	4	O	O: 1300 *pages*	1
Study references	-	95 *pages*	*Sets*	-	-	-	-	-	P	P: 95 *pages*	1
Lesson plans	-	20 *pages*	*Sets*	-	-	-	-	-	Q	Q: 20 *pages*	1

[a] For any given year, the number of courseware copies required equals the *maximum* of all shifts for display media and software, and the *sum* of all shifts for printed media.

[b] All interpolated values having fractional parts have been rounded to the next highest integer.

learning events requiring one and two copies; and one for learning events requiring two and three copies. The number of courseware measures in the combined package are determined by summing the courseware measures in the individual packages.

Whenever courseware is grouped, as above, the number of distinct learning events in the package should be used to calculate the packaging cost per copy. For example, Package D comprises four distinct learning events and the packaging cost for the grouped entry will, therefore, be four times the cost of a single entry.

MODCOM Worksheet 5: Hardware Requirements

Since hundreds of individual hardware items may be involved in the conduct of a course, the planner is urged to group these items whenever possible in order to reduce the number of separate inputs. This concept is most easily conveyed by the example below. If several learning events require essentially the same package of equipment with but minor differences, then the basic package should be identified as one hardware type and any supplementary equipment as a separate type(s).

Hardware Set	*Units per Set*
Darkroom equipment	
Enlarger	1
Darkroom sets (trays, clip containers, etc.)	1
Tool kit	
Tool chest	1
Electric drill	1
Screwdriver set	1
Socket set	1
Torque wrench	1

Hardware Unit Requirements. If the course planner has been diligent in exercising RUM, then all hardware types should be identified in the RUM output (Printout 5, [A]). For hardware used only in the classroom, the number of units required equals the "total number of units currently in system" (Printout 5, [B]). For hardware used only in homework sessions (such as the audio still visual teaching machines in the MODCOM sample case), the number of units required is equal to the *maximum* "number of courseware copies required" (Worksheet 3, column 17) in any learning event utilizing the subject hardware. If the hardware is used for both classroom and homework sessions, the appropriate value is the *maximum* of the classroom and homework values.

For multishift operations, the *maximum* of the individual shift values for a given year should be chosen.

Average Daily Utilization Rate. The average daily utilization rate for hardware used only in the classroom can be derived from the RUM output "average percent unit-hours fully idle" (Printout 5, [C]) as follows:

> Average daily utilization rate (in hours) = (1 − average percent unit-hours fully idle ÷ 100) * (number of classroom training hours per student per day).

MODCOM Worksheet 5

Hardware Requirements

Hardware Type	Units of Hardware Required in Year Z (Maximum of all shifts)					Average Daily Utilization Rate in Year Z (Sum of all shifts, in hours)				
	Z=1	Z=2	Z=3	Z=4	Z=5	Z=1	Z=2	Z=3	Z=4	Z=5
AN/URN-5 LF beacon	4	5	5	5	4	.94	1.16	1.37	1.16	.94
Test set 1	4	5	5	5	4	.94	1.16	1.37	1.16	.94
Test set 2	4	5	5	5	4	.94	1.16	1.37	1.16	.94
Signal generator	4	5	5	5	4	.94	1.16	1.37	1.16	.94
Overhead projector	2	3	3	3	2	.96	.99	1.02	.99	.96
ASV teaching machine	6	8	9	8	6	.43	.40	.36	.40	.43
SV teaching machine	8	10	12	10	8	.67	.80	.94	.80	.67

For hardware used only in homework sessions (such as the audio still visual teaching machines in the MODCOM sample case), the utilization rate can be derived from the RUM output "average number of students" (Printout 6, [A]), the UI interactive input "average daily homework" (Printout 1, [B]), and the previously derived "hardware unit requirements" (initial columns of Worksheet 5) as follows:

> Average daily utilization rate (in hours) = (average of the average number of students in learning events immediately preceding homework events utilizing the subject hardware *divided by* the hardware unit requirement) • (average daily homework ÷ 60).

For hardware used in both classroom and homework sessions, the classroom and homework utilizations should be *summed*.

For multishift operations, the above calculations should be done for each shift and then *summed* over all shifts.

MODCOM Worksheet 6: Facility Requirements

As with hardware, facilities are most conveniently treated as packages and may be defined to include such furnishings (overhead hardware) as will be needed. Two examples of facility packages follow:

Facility Package	*Number*
Classroom	
Instructor's desk	1
Swivel chair	1
Student desks	20
Chalkboard	1
Storage cabinet	1
Floor space (sq ft)	400
Tutoring room	
Table	1
Chair	2
Chalkboard	1
Floor space (sq ft)	40

Facility Unit Requirements. All types of facilities should be identified in RUM output (see Printout 5, [A]) and the number of each type required ("total number of units currently in system") (see Printout 5, [B]). For multishift operations, the *maximum* of the individual shift values should be selected.

MODCOM Worksheet 6

Facility Requirements

Facility Type	Number of Units of Facility Required in Year Z (Maximum of all shifts)				
	Z=1	Z=2	Z=3	Z=4	Z=5
Room 1	2	2	2	2	2
Room 2	1	2	2	2	1
Room 3	1	1	1	1	1
Lab	1	1	1	1	1

III. INPUT PREPARATION

This section explains the operation of MODCOM in terms of input requirements and available options.

A. INPUT CARDS

The MODIA Cost Model recognizes 15 distinct data input formats and one data termination card. Listed below are the format number, title, and page on which it is described for each of the cards:

Format Card		*Page*
1	Title Card	37
2	Course Duration Inputs	38
3	Student Inputs	39
4	Instructor Inputs	42
5	Courseware Procurement Inputs	45
6	Curriculum Manpower Inputs	49
7	Hardware Procurement Inputs	51
8	Hardware Maintenance Manpower Inputs	56
9	Facility Procurement Inputs	58
10	Facility Maintenance Manpower Inputs	60
11	Training Administrative, Base Operating Support, and Medical Manpower Inputs	62
12	Computer Service Charges	64
13	Optional Officer/Airman/Civilian Distribution Overrides	64
14	Optional Miscellaneous Overrides	67
15	Optional Pay and Allowance Overrides	69
99	Termination Card	71

Notes of a general nature include the following:

Format Number. The format number is always punched into the first two columns of each input card.

Blanks. Unless otherwise specified (see Formats 13 and 14), all blanks in numeric fields will be read as zeros.

Mandatory Inputs. There are two inputs which must have a nonzero value: "average course duration per graduate (in hours)" and "entry interval (in hours)" (Format 2). Failure to enter a nonzero value for either of these inputs will result in the printing of a MODCOM error message and program termination. The reason for this constraint is that if zero is entered (or the field is left blank), the possibility of a zero divisor exists.

Mandatory Cards. Each submittal of a MODCOM computer run must contain one Format 2 card and one Format 99 card. The Format 2 card is mandatory because it contains mandatory inputs (see above). The Format 99 card is the flag

signifying the end of the input data. Failure to include either card in the data deck will result in the printing of an error message and immediate program termination.

Card Limit. To reserve core memory, limits had to be put on the number of cards of each format type that could be entered for a single run of the Cost Model. This limit is indicated in the upper right-hand corner of each input form. Cards in excess of that limit are deleted from further processing.

Card Deletions. Throughout this section, mention is made of card deletions (cards excluded from further processing) that will occur if certain MODCOM input conditions are violated (input not within acceptable range, illegal input combination, etc.). All such card deletions, with the appropriate error message, will be listed as part of MODCOM output.

Decimal Points. All input data are entered as real (floating-point) numbers. The implied decimal point location is at the right end of each field unless otherwise specified. However, a punched decimal point always overrides an implied decimal point location.

"Year 0." "Year 1" is assumed to be the first year of course instruction, "year 0" the year immediately preceding it. All initial course development, initial hardware procurement, and initial facility construction are assumed accomplished in year 0.

Number of Years. The course planner does not have to enter inputs for all 5 course years; any number of years in the range 1 through 5 is acceptable.

Detail of Inputs. A fairly sizable number of distinct and detailed inputs are contained on the MODCOM input formats. This was done so as to place before the course planner an exhaustive list of all factors that might conceivably affect course costs. However, if he felt that any of these factors were irrelevant, he would not have to enter values for these inputs.

Typical Values. A listing of typical value sources is furnished on p. 71. The intent of these typical values is to provide guidance, not restriction. If the planner has more accurate information, he should use that information.

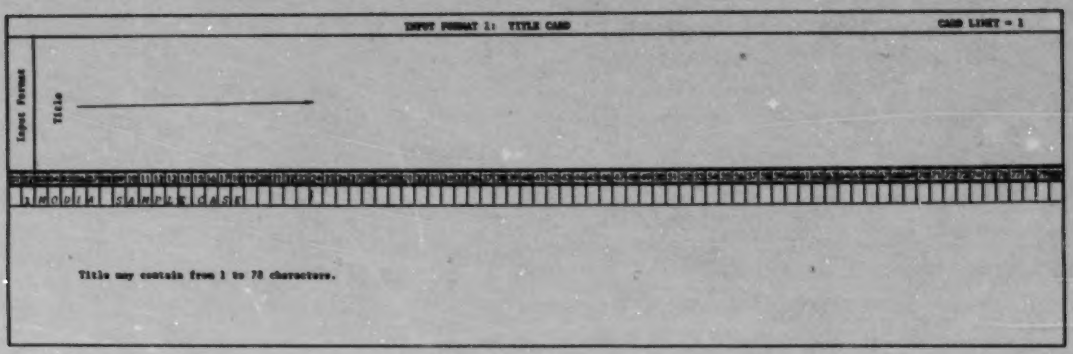
Year of Dollars. All costs presented in this section are in FY75 dollars.

Nondollar Costs. In certain instances it may not be possible to put a particular cost in dollar terms (e.g., computer service charges). When this occurs, the planner is advised to use some other measure of resource utilization (e.g., CPU seconds, number of core bytes used) and keep track of this utilization outside the formal structure of the Cost Model.

Worksheet References. The worksheet references accompanying various inputs refer to the worksheets used in Section II to assist the planner in making UI/RUM output suitable for MODCOM input. Planners exercising the Cost Model independently of UI/RUM and who have not completed these MODCOM worksheets, must supply their own input values.

Format 1: Title Card

This card is used to identify MODIA Cost Model runs. The title, to be entered in columns 3 through 80, may contain between 1 and 78 alpha-numeric characters. If this card is excluded, the default title "MODIA Cost Model" is used.



Format 2: Course Duration Inputs

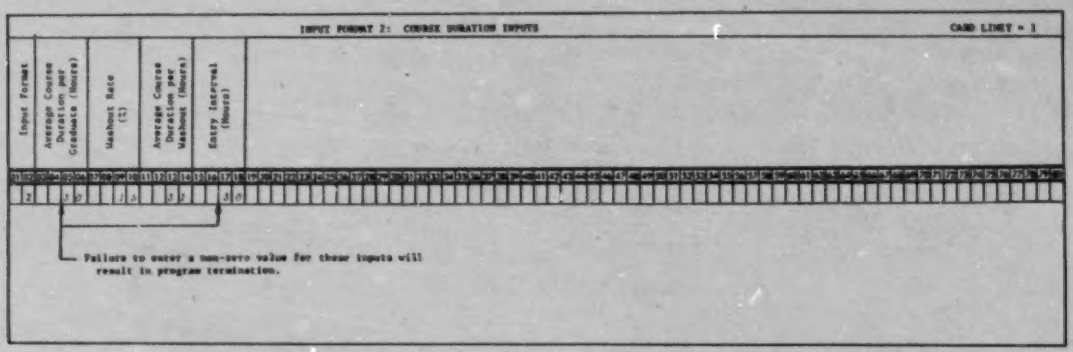
This card contains inputs required for determining the student load (man-years).

Columns 3-6 (4-column numeric field). Average course duration per graduate (in hours): the average length of time it will take a graduate to complete the course. Failure to enter a value greater than zero but less than the hour equivalent of two classroom years[1] will result in program termination (Worksheet 1).

Columns 7-10 (4-column numeric field). Washout rate (percent): the ratio of the number of washouts (multiplied by 100) to the total number of entrants (Worksheet 1).

Columns 11-14 (4-column numeric field). Average course duration per washout (in hours): the average length of time a washout remains in the course. Washout durations exceeding the hour equivalent of one classroom year will automatically be reset to the one-year equivalent (Worksheet 1).

Columns 15-18 (4-column numeric field). Entry interval (in hours): the average length of time separating entry classes (Worksheet 1).


INPUT FORMAT 2: COURSE DURATION INPUTS
CARD LIMIT = 1
Input Format
Average Course Duration per Graduate (Hours)
Washout Rate (%)
Average Course Duration per Washout (Hours)
Entry Interval (Hours)
Failure to enter a non-zero value for these inputs will result in program termination.

[1] Normally 3022 hours (see footnote at bottom of page 25 for derivation).

Format 3: Student Inputs

This card contains inputs relating to the number and type of student entrants, graduates, and man-years.

Breakdown of Student Entrants. The course planner must determine the breakdown of total annual student entrants (Worksheet 1) by personnel type (Active Duty Force pipeline, Active Duty Force lateral/upgrade, Guard/Reserve pipeline, Guard/Reserve lateral/upgrade, other DoD pipeline, other DoD lateral/upgrade, non-DoD),[2] personnel designator (officer, airman, civilian), and pay grade. Typical pay grades for Air Force pipeline and lateral/upgrade students are given in Table 3. (Civilian students could not be included in this table as they have been relatively few in number and variations in their pay grades have been wide.)

Table 3

Typical Student Pay Grades

	Officer	*Airman*
Pipeline students	O-1	E-1
Lateral or upgrade students	O-2 through O-4	E-3 through E-5

Columns 3-4 (2-column numeric field). Personnel type: numeric personnel-type code as follows:

1 = Active Duty Force pipeline student
2 = Active Duty Force lateral/upgrade student
3 = Guard/Reserve pipeline student
4 = Guard/Reserve lateral/upgrade student
5 = Other DoD (Army, Navy) pipeline student
6 = Other DoD (Army, Navy) lateral/upgrade student
7 = Non-DoD student (e.g., Military Assistance Program (MAP) student)

Use of a code outside the range 1 through 7 will result in the deletion of that card.

Columns 5-6 (2-column numeric field). Personnel designator: numeric personnel-designator code as follows:

1 = Officer
2 = Airman
3 = DoD Civilian–GS (General Schedule)
4 = DoD Civilian–WB (Wage Board)
5 = Non-DoD

[2] *Active Duty Force* encompasses all Air Force students except those assigned to the Air National Guard and the Air Force Reserve. *Guard and Reserve* refers only to Air Force Guard and Reserve students. Students assigned to DoD agencies other than the AF, such as the Army and Navy (including their Guard and Reserve components) are classified as *Other DoD.* Finally, students from non-DoD agencies and from foreign governments are termed *Non-DoD.*

A *pipeline* student is one who has not yet held an initial duty assignment. A *lateral or upgrade* student is a student who has had operational experience and is either being retrained or upgraded.

INPUT FORMAT 3: STUDENT INPUTS — CARD LIMIT = 75

Input Format	Personnel Type	Personnel Designator	Pay Grade	Input Option	Number of Student Entrants in Year Z					Optional Thruput of Graduates and Man-Years: Number of Student Graduates in Year Z						Number of Student Man-years in Year Z				
					Z = 1	Z = 2	Z = 3	Z = 4	Z = 5	Z = 1	Z = 2	Z = 3	Z = 4	Z = 5	In Progress	Z = 1	Z = 2	Z = 3	Z = 4	Z = 5
3	1	2	1	1	403	604	806	604	403											

1 = Active Duty Force Pipeline Student
2 = Active Duty Lateral or Upgrade Student
3 = Guard/Reserve Pipeline Student
4 = Guard/Reserve Lateral or Upgrade Student
5 = Other DoD (Army, Navy) Pipeline Student
6 = Other DoD (Army, Navy) Lateral or Upgrade Student
7 = Non-DoD (MAP) Student

1 = Officer
2 = Airmen
3 = Civilian-GS
4 = Civilian-WB
5 = Non-DoD

Option to calculate graduates and man years (=1) or thruput graduates and man-years (=2)

Use of a code outside the range 1 through 5 will result in the deletion of that card. Additionally, card deletion will occur if personnel *designator* 5 is used in combination with any personnel *type* other than 7.

Columns 7-8 (2-column numeric field). Pay grade: standard U.S. Government numeric pay-grade codes. The code entered in these columns must be within the range of permissible pay grades for the specified personnel designator or the card will be deleted. A duplicate personnel type/personnel designator/pay-grade combination will also cause a card to be deleted. The number of unique pay grades entered for a given personnel type/personnel designator combination will depend on the required level of accuracy and the ambition of the user. Each pay grade requires a separate card entry. ATC generally uses a single pay grade (the modal) for each personnel type/personnel designator combination. In order to reduce the planner's input requirements, pay and allowance (P&A) factors for each pay grade have been stored as part of the model. These pay factors, assumed to apply across DoD, may be overridden for any run (see Format 15). The codes and their corresponding pay factors are as follows:

Officer (Personnel Designator = 1)

Pay Grade Code	*Stored P&A Factor ($)*	*Corresponding Air Force Rank*
10	43,084	General
9	40,041	Lieutenant General
8	38,385	Major General
7	33,867	Brigadier General
6	29,384	Colonel
5	24,887	Lieutenant Colonel
4	20,624	Major
3	17,876	Captain
2	13,681	First Lieutenant
1	10,004	Second Lieutenant
Blank or 0	18,297	Overall Officer Average

Airman (Personnel Designator = 2)

Pay Grade Code	*Stored P&A Factor ($)*	*Corresponding Air Force Rank*
9	17,002	Chief Master Sergeant
8	14,638	Senior Master Sergeant
7	12,779	Master Sergeant
6	11,201	Technical Sergeant
5	9,583	Staff Sergeant
4	7,791	Sergeant
3	6,579	Airman First Class
2	6,024	Airman
1	5,430	Airman Basic
Blank or 0	8,557	Overall Airman Average

Civilian (Personnel Designators = 3 and 4)		
Pay Grade	*Stored P&A Factor ($) for GS Civilians (=3)*	*Stored P&A Factor ($) for WB Civilians (=4)*
18	39,060	
17	39,060	
16	39,060	
15	35,823	
14	30,377	15,157
13	26,053	14,776
12	22,285	13,845
11	18,935	13,373
10	17,041	12,758
9	15,717	12,127
8	14,254	11,471
7	13,828	11,077
6	11,782	10,527
5	10,483	9,587
4	9,266	9,214
3	7,953	8,896
2	6,447	8,491
1	5,651	7,912
Blank or 0 (Average)	12,599	11,464

Additionally, a dummy pay and allowance schedule has been set up for non-DoD students, with 20 possible pay grades. However, because of the wide range of possible pay rates, typical values could not be established, and consequently, the stored values were set equal to zero. If the planner feels that non-DoD student pay and allowances are relevant to a particular costing exercise, the pay factor override option should be employed to introduce the appropriate pay rate.

Column 9 (1-column numeric field). Input option: option to calculate (=1) or thruput (=2) the number of student graduates and man-years. If the calculation option is selected, the model will automatically generate time-phased graduate and man-year estimates.[3] If the thruput option is selected, the planner is responsible for providing all entrant, graduate, and man-year estimates and ensuring the corresponding consistency of the washout rate entered on Format 2.

Columns 10-29 (five 4-column numeric fields). Number of student entrants in year Z.

Columns 30-53 (six 4-column numeric fields). Number of student graduates in year Z. The column headed *In Progress* is for those students who entered during the five-year MODCOM time period but who will graduate subsequent to that period.

Columns 54-73 (five 4-column numeric fields). Number of student man-years (including washout man-years) in year Z.

Format 4: Instructor Inputs

This card contains inputs pertaining to the size and training of the instructor force.

[3] The general equation forms used to generate the graduate and man-year estimates may be found on p. 89.

INPUT FORMAT 4: INSTRUCTOR INPUTS

CARD LIMIT = 25

Input Format	Personnel Type	Personnel Designator	Pay Grade	Size of Initial Instructor Cadre (Year 0)	Number of Months Instructors On-Board in Year 0	Number of Instructor Man-years in Year Z					Turnover Rate (%)	Cost of Initial Instructor Factory Training per Instructor ($)	Cost of Instructor Education Training per Instructor ($)
						Z = 1	Z = 2	Z = 3	Z = 4	Z = 5			
4	2	2	5	4	7	4	4.5	5	4.5	4	3.5	5500	1096
4	8	3	9	0	0	3	3	3	2	2	6	8	0
4	8	3	11	0	0	.07	.1	.14	.7	.07	5	0	0
4													
4													
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4													
4													

1=Officer
2=Airman
3=Civilian-GS
4=Civilian-WB

8=Air Force Instructors
9=Other DoD (Army, Navy) Instructors

Breakdown of Instructor Force. The course planner must determine the classification of instructor man-years (Worksheet 2) by personnel type (Air Force, other DoD), personnel designator (officer, airman, civilian), and pay grade. Typical pay grades for the two instructor types the AF distinguishes are provided in Table 4.

Table 4

Typical Instructor Pay Grades

Instructor Type	*Officer*	*Airman*	*Civilian*
Academic, remedial, and special requirements instructors	O-3	E-5	GS-9
Instructor supervisors	O-3	E-6, E-7	GS-11

Columns 3-4 (2-column numeric field). Personnel type: numeric personnel type code as follows:

8 = Air Force Instructor
9 = Other DoD (Army, Navy) Instructor

Use of a code other than 8 or 9 will result in the deletion of that card.

Columns 5-6 (2-column numeric field). Personnel designator: numeric personnel designator code as follows:

1 = Officer
2 = Airman
3 = Civilian-GS
4 = Civilian-WB

Use of a code outside the range 1 through 4 will result in the deletion of that card.

Columns 7-8 (2-column numeric field). Pay grade: standard U.S. Government numeric pay-grade codes. The codes and stored pay factors are the same as those for Format 3. As before, the code entered in these columns must be within the range of permissible pay grades for the specific personnel designator or the card will be deleted. A duplicate personnel type/personnel designator/pay-grade combination will also cause a card to be deleted.

Columns 9-13 (5-column numeric field). Size of initial instructor cadre in year 0: the number of instructors (*not* man-years) brought on-board in year 0 to develop curriculum and have any factory training that is required.

Columns 14-17 (4-column numeric field). Number of months instructors on-board in year 0: the number of months in year 0 that the average instructor in the initial instructor cadre will spend preparing for the subject course. This value, which must be supplied by the planner, should include time required for special factory training and education training as well as time needed for curriculum development. It should also be consistent with the input for the size of the initial instructor cadre and the percentage of courseware development accomplished by instructors (see Format 6). Typical values are as follows:

Factory Training	1 to 12 weeks
Education training	6 weeks
Curriculum development	12 weeks
	19 to 30 weeks (~4 to 7 months)

Columns 18-42 (five 5-column numeric fields). Number of instructor *man-years* in year Z.

Columns 43-45 (3-column numeric field). Turnover rate (percent): the percentage of instructors who will be replaced each year (the reciprocal of the average instructor's tour length times 100). Typical values are as follows:

	Turnover Rate
Officer (3-year tour)	33%
Airman (3-year tour)	33%
Civilian (20-year tour)	5%

Columns 46-51 (6-column numeric field). Cost per instructor of initial factory training ($): the total cost, less student pay and allowances, of providing an instructor in the initial cadre with the specialized equipment or system-training he needs for developing and conducting his course. This initial specialized training is usually accomplished at a private contractor's facility. Subsequent specialized training of instructors is usually provided informally by the existing instructor nucleus. This total cost should include travel per diem, transportation expenses, destination per diem, and attendance fees (or contract costs), as applicable. The pay and allowances of the initial instructor cadre while in student status will be accounted for elsewhere. Typical values are as follows:

Contract cost	$1500 to $3000
Transportation	$ 170
Destination per diem	
Officer	$ 11
Airman	$ 4
Civilian	$ 21

Columns 52-56 (5-column numeric field). Cost per instructor of instructor education training ($): the cost of the six-week instructor prerequisite course on education principles (course number 3AIR75100-3). The current cost of this course, given by ATC at each of its technical training centers is $1069 per student exclusive of student pay and allowances. As before, the pay and allowances of the instructors while in student status will be accounted for elsewhere.

Format 5: Courseware Procurement Inputs

The Cost Model recognizes four classes of courseware: (1) printed media, such as textbooks and workbooks, that are intended for both students and instructors; (2) printed media, such as lesson and evaluation guides, that are intended only for instructors; (3) display media, such as films, slides, and charts; and (4) software,

INPUT FORMAT 5: COURSEWARE PROCUREMENT INPUTS

CARD LIMIT = 200

Input Format	Courseware ID#	Class	Name of Courseware	Name of Courseware copies (e.g. books, reels, sets)	Name of Courseware Measure (e.g., pages, slides)	Number of Copies of Courseware Required in Year Z					Total Number of Courseware Measure/ Copy	Initial Preparation Cost/ Courseware Measure ($)	Copy Cost/ Courseware Measure ($)	Packaging Cost/Copy ($)	Annual Revision Rate (%)	Annual Replacement Rate (%)
						Z=1	Z=2	Z=3	Z=4	Z=5						
01 02	03 04	05	06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27	28 29 30 31	32 33 34 35 36 37	38 39 40 41	42 43 44 45	46 47 48 49	50 51 52 53	54 55 56 57	58 59 60 61	62 63 64 65 66	67 68 69 70	71 72 73 74	75 76 77 78	79 80
5	1 3	3	TRANSPARENCIES (GRP A)	SETTRANSP		1	2	3	3	3	1 95	7.45	.05	0	20	0
5	2 3	3	TRANSPARENCIES (GRP B)	SETTRANSP		2	3	3	3	3	2 15	7.45	.05	0	20	0
5	3 3	3	TRANSPARENCIES (GRP C)	SETTRANSP		1	1	1	1	1	1 15	7.45	.05	0	20	0
5	4 3	3	FILMSTRIP (GRP D)	FMSTFRAMES		5	7	9	7	5	105	30	.7	0	20	0
5	5 3	3	FILMSTRIP (GRP E)	FMSTFRAMES		5	7	8	7	5	13	30	.7	0	20	0
5	6 3	3	FILMSTRIP (GRP F)	FMSTFRAMES		4	5	6	5	4	13	30	.7	0	20	0
5	7 3	3	FILMSTRIP (GRP G)	FMSTFRAMES		6	7	8	7	6	53	30	.7	0	20	0
5	8 3	3	AUDIOTAPE (GRP H)	CASS MIN		5	7	9	7	5	105	8	.1	0	20	60
5	9 3	3	AUDIOTAPE (GRP I)	CASS MIN		5	7	8	7	5	13	8	.1	0	20	60
5	10 3	3	AUDIOTAPE (GRP J)	CASS MIN		4	5	6	5	4	13	8	.1	0	20	60
5	11 3	3	AUDIOTAPE (GRP K)	CASS MIN		6	7	8	7	6	53	8	.1	0	20	60
5	12 1	1	PROGRAMMED TEXT	TEXT PAGES							720	7.25	.008	3	20	0
5	13 3	3	FILMSTRIP (GRP M)	FMSTFRAMES		6	9	11	9	6	59	8.55	.35	0	20	0
5	14 3	3	FILMSTRIP (GRP N)	FMSTFRAMES		8	10	12	10	8	216	8.55	.35	0	20	0
5	15 1	1	TECH ORDERS	SETS		4	5	5	5	4	13 00	0.00	08	3	20	0
5	16 1	1	STUDY REFERENCES	SETS PAGES							95	7.25	.008	3	20	0
5	17 2	1	LESSON PLANS	SETS PAGES							20	7.25	.008	3	20	0
5																
5																
5																

Each courseware type gets unique ID # in range 1 thru 99.

1 = Printed media for students and instructors
2 = Printed media for instructors only
3 = Display media
4 = Software

For classes 1 and 2 only: if all five fields (years) are left blank, then the number of units required will automatically be generated by the model.

such as teaching machine programs. Four separate procurement costs are estimated: (1) the initial cost of producing the master from which all subsequent copies will be made; (2) the cost of reproducing and packaging the required number of copies; (3) the annual cost of revision due to change in course content; and (4) the annual cost of replacement due to loss, damage, or normal aging. The cost of courseware development, such as writing and editing, is accounted for within curriculum manpower pay and allowances.

Columns 3-4 (2-column numeric field). Courseware ID number: unique number in range 1 through 99 assigned by the user to each courseware type. A card will be deleted if its ID number duplicates that of another card or if its ID number falls outside the prescribed range.

Column 5 (1-column numeric field). Class: numeric courseware class code as follows:

1 = Printed media for students and instructors (texts, workbooks)
2 = Printed media for instructors only (lesson and evaluation guides)
3 = Display media (films, slides)
4 = Software (teaching machine programs)

Use of a code outside the range 1 through 4 will result in the deletion of that card.

Columns 6-27 (22-column alpha-numeric field). Name of courseware: user-selected name for identifying each courseware type.

Columns 28-31 (4-column alpha-numeric field). Name of courseware copies: user-selected name for identifying the unit denominator (book, reel, set) of each courseware type (Worksheet 4).

Columns 32-37 (6-column alpha-numeric field). Name of courseware measure: user-selected name for identifying the unit of measure (pages, minutes, slides, etc.) for each courseware type (Worksheet 4).

Columns 38-57 (five 4-column numeric fields). Number of copies of courseware required in year Z, exclusive of master, which is never put into classroom use (Worksheet 4). As explained in Section II (p. 30), the planner has the option of having the model internally generate printed media (classes 1 and 2) copy requirements. This option is accessed by leaving all five fields (years) blank. If a number other than zero appears in *any* of the five fields, the option will not be utilized. Note that all printed media which is *directly input* is assumed to have a one-year life, an assumption which could lead to a slight overstatement of cost for undistributed printed media such as reference manuals and technical orders.

Columns 58-61 (4-column numeric field). Total number of courseware measures per copy: the number of pages, slides, or minutes, etc., per unit of courseware (Worksheet 4).

Columns 62-66 (5-column numeric field). Initial preparation cost per courseware measure ($): the cost of producing a single measure of master courseware. This includes all labor and material required to produce the master except script writing and editing. Some typical values are provided in Table 5. If the values in this table are not deemed sufficiently accurate, or if a required courseware type is not listed, then the Training Services Division should be consulted. They are responsible for the production of most new courseware.

Table 5

Rules of Thumb for Estimating Courseware Procurement Costs

Medium	Specific Courseware Type	Content	Courseware Measure	Initial Preparation Cost per Courseware Measure ($)	Copy Cost per Courseware Measure ($)
AMV	Sound film				
	Super 8	Realia	Minutes	207	6.66
	16-millimeter	Realia	Minutes	200	4.75
	Kinescope recording, 16-mm	Realia	Minutes	130	4.75
	Animated sequence, Super 8	Illustration	Minutes	Unknown	Unknown
	Videotape				
	1/2-inch tape	Realia	Minutes	100	0.78
	3/4-inch tape	Realia	Minutes	100	0.85
	1-inch tape	Realia	Minutes	100	1.20
	Television, live transmission	Realia	Minutes	80	Not applicable
ASV	Sound filmstrip, 35-mm, color, with audio tape	Illustration/ spoken word	Minutes	30/8	0.70/0.10
	Sound slide set, 2 in. by 2 in., with audio tape	Illustration/ spoken word	Minutes	30/8	0.70/0.10
	Sound-on-slide set, 2 in. by 2 in., color	Illustration/ spoken word	Slides	30/unknown	0.70/unknown
MV	Silent film, Super 8	Realia	Minutes	168	6.66
SV	Filmstrip, 35-mm				
	Color	Illustration	Frames	8.55 to 22.00	0.35
	Black and white	Illustration	Frames	2.55 to 10.90	0.33
	Slides, 2 in. by 2 in.				
	Color	Realia	Slides	0.40	0.35
		Illustration	Slides	8.55 to 22.00	0.35
	Black and white	Realia	Slides	0.70	0.35
		Illustration	Slides	2.55 to 10.90	Unknown
	Transparencies, 8.5 by 11 in.	Illustration	Transparencies	7.45 to 115.45	Unknown
	Microfilm, 35-mm	Text, illustration	Frames	Unknown	Unknown
	Microfiche, 4 in. by 6 in.	Text, illustration	Cards	Unknown	Unknown
	Printed page	Text	Pages	7.25	.0085
		Illustration	Pages	14.40 to 430.90	.0085
	Charts, maps	Illustration	Charts, maps	10.95 to 22.00	Not applicable
	Photographs, 8 in. by 10 in.				
	Color	Realia	Photos	1.05	0.50
	Black and white	Realia	Photos	0.30	0.11
A	Audio tape	Spoken word	Minutes	3.00	0.10
	Audio disc	Spoken word	Minutes	Unknown	Unknown
	Radio, live transmission	Spoken word	Minutes	Unknown	Unknown
T	Teaching machine program	Computer-coded instructions	Instructions	Unknown	Unknown

Columns 67-70 (4-column numeric field). Copy cost per courseware measure ($): the cost of copying (labor and material) a single measure of master courseware. Typical values are again provided in Table 5.

Columns 71-74 (4-column numeric field). Packaging cost per copy: the cost of cassettes, reels, trays, etc., per courseware copy. Some typical values are as follows:

Sound on slide tray	$30.00
Slide tray for 40 slides, straight	1.25
Slide tray for 120 slides, carrousel	3.00
Film reel and container (400 feet)	1.50
Filmstrip containers	.25
Loose-leaf binder (3.5-inch, telescoping poles)	3.00

For courseware which has been grouped, the packaging cost per unit should be multiplied by the packaging factor (Worksheet 4).

Columns 75-77 (3-column numeric field). Annual revision rate (percent): the percentage of actual presentation minutes which can be expected to be revised annually for each courseware type. These annual changes in course content may be caused by such things as modifications in mission equipment, a required upgrading of student capabilities, or an effort to make better use of course resources. The model assumes that after the revisions are made to the master, copies will be made of the revised portions and integrated into existing copies. The determination of this value is left to the judgment of the course planner. (Normally the annual revision rate does not exceed 20 percent.)

Columns 78-80 (3-column numeric field). Annual replacement rate (percent): the percentage of each courseware type's units which will need to be replaced annually due to damage or normal aging. This value can be approximated by multiplying the reciprocal of the estimated useful life (in years) by 100. Typical values are as follows:

Courseware Type	*Estimated Useful Life (in years)*
Videotape	1 to 5 years depending on use
Audiotape	1 to 10 years depending on use
Film	2 to 5 years depending on use
Filmstrip	Unknown
Photos	Indefinite
Slides	Indefinite
Transparencies	Indefinite
Printed material	Indefinite
Charts, maps	Indefinite
Microfiche	Indefinite
Microfilm	Unknown
Record	1 to 5 years depending on use

Format 6: Curriculum Manpower Inputs

Curriculum personnel determine training requirements and develop course written material. Normally attached to the Curricula Unit of a training department, curriculum personnel share the task of courseware development with the course's instructors.

Columns 3-4 (2-column numeric field). Courseware ID number: the number used to identify the same courseware type on Format 5. A Format 6 card will be deleted if its ID number does not have a match on a Format 5 card, or if its ID number duplicates that of another Format 6 card. Courseware manpower that is calculated may be aggregated by teaching agent and teaching format and entered under existing Format 5 ID numbers. Courseware manpower that is thruput may be aggregated and entered under a single existing Format 5 ID number.

Columns 5-6 (2-column numeric field). Input method: option to calculate (=1) or thruput (=2) the number of curriculum man-years associated with a given courseware type.[4] Failure to enter a value of 1 or 2 will result in card deletion and

[4] The curriculum manpower estimating relationship used in conjunction with the calculation option is provided on p. 90.

INPUT FORMAT 6: CURRICULUM MANPOWER INPUTS

CARD LIMIT = 200

Input Format	Courseware ID#	Input Method	Method 1: Calculation			Method 2: Thruput						
			Number of Classroom Instruction Hours	Curriculum Man-hours per Classroom Instruction Hour	% Accomplished by Instructors	Number of Curriculum Man-Years Required in Year Z						
						Z=0	Z=1	Z=2	Z=3	Z=4	Z=5	
01 02	03 04	05 06	07 08 09 10 11	12 13 14 15 16	17 18 19	20 21 22 23	24 25 26 27 28	29 30 31	32 33 34 35	36 37 38 39	40 41 42 43	44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
6	1	1	8.2	34.6	80							
6	2	1	8.2	20.8	80							
6	3	1	8.5	5	80							
6	4	1	4.0	90	80							
6	5	1	8.0	11.7	80							
6	6	1	30.0	5	80							
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1 = Calculation
2 = Thruput

Courseware ID numbers used on this format must have corresponding ID# on format 5

NOTE: Courseware ID#5 represents the study references while courseware ID#6 represents the lesson plans.

the exclusion of that particular couseware's manpower and manpower-related cost from the output. Additionally, entries made in columns not encompassed by the designated input method are disregarded by the MODCOM program.

Columns 7-11 (5-column numeric field). Number of classroom instruction hours: the number of nonredundant classroom instruction hours taken up by a given courseware type. The value entered in this field should equal "average minutes" (Worksheet 3, column 8) divided by 60.

Columns 12-16 (5-column numeric field). Number of curriculum man-hours per classroom instruction hour: the number of initial development curriculum man-hours required for each nonredundant classroom instruction hour. Generally speaking, this number is a function of the teaching agent and the teaching format and independent of the courseware type. Typical values are provided in Table 6.

Columns 17-19 (3-column numeric field). Percentage accomplished by instructors: the percentage of curriculum development done by instructors rather than curriculum personnel. Historically, this value has ranged from 80 to 90 percent.

Columns 20-43 (six 4-column fields). Number of curriculum man-years required in year Z.

Format 7: Hardware Procurement Inputs

The Cost Model estimates four types of hardware procurement costs: 1) the cost of purchasing[5] the incremental number of units required each year, including initial replacement part stocks; 2) credits for any surplus items returned to inventory; 3) the annual cost of replacing units worn out during the year; and 4) the annual cost of miscellaneous repair parts and of contractual maintenance.

Columns 3-4 (2-column numeric field). Hardware ID number: unique number in range 1 through 99 assigned by the user to each hardware type. A card will be deleted if its ID number duplicates that of another card of if the number falls outside the prescribed range.

Column 5 (1-column numeric field). Class: numeric hardware class code as follows:

1 = Media hardware (slide projectors, motion picture projectors, tape recorders, teaching machines)
2 = Special equipment (trainers, stripped-down aircraft, tool kits)
3 = Overhead (general utility) hardware (chairs, desks)

Use of a code outside the range 1 through 3 will result in the deletion of that card.

Columns 6-30 (25-column alpha-numeric field). Name of hardware type: user-selected name for identifying each hardware type (Worksheet 5).

Columns 31-50 (five 4-column fields). Number of units of hardware required in year Z (Worksheet 5).

Columns 51-58 (8-column numeric field). Cost per unit ($): either the imputed value,[6] if it is an inherited asset, or the purchase price, if it is to be a newly acquired asset. Normally, an AF planner will consult his own service's supply manual to determine the unit costs of hardware. So as not to limit possible hardware items

[5] Leasing costs for any computer hardware should be entered on a Format 12 card.
[6] See p. 9.

Table 6

Initial Development Curriculum Man-Hours per Classroom Instruction Hour[a]

Teaching Format[b]	*Teaching Agent*[b]			
	Learner[c]	*Instructor*[d]	*Response-paced Program*[e]	*Adaptive Program*[f]
Group interaction[g]; Simple[h]; Recitation[i]	11.7	5.0	Not applicable	Not applicable
Response-paced[j]	90.0	38.2	148.0	Not applicable
Adaptive[k]	208.0	88.2	Not applicable	346.0

[a]Revision-development curriculum man-hours are usually half initial development curriculum man-hours.

[b]The terms under Teaching Agent and Teaching Format are explained in greater detail in *MODIA: VOL. 2, Options for Course Design*, R-1701-AF.

[c]A trainee; person taking the course.

[d]A person qualified to teach the course through training in the subject matter and in the techniques of instruction.

[e]A device or machine that presents the subject matter, elicits an overt response from the student, senses the response, and proceeds with the presentation if the response is acceptable; a teaching machine with selected response.

[f]A device or machine, usually a computer, that presents the subject matter, elicits an overt response from the student, senses the response, and selects the content of the next presentation on the basis of the response.

[g]A group of students discuss the subject matter interactively.

[h]The subject matter is presented or demonstrated to the student; the student is directed to perform; the student is given a set of stimuli for drill or practice.

[i]The student is required to respond overtly during the instruction to indicate that he understands, remembers, or can perform what he is supposed to be learning. The teaching agent receives and processes the student's responses.

[j]The recitation format is taken one step further in that the rate at which the instruction is given is matched to the rate at which students learn the subject.

[k]The response-paced format is taken still one step further in that the content of the instruction is also adjusted.

INPUT FORMAT 7: HARDWARE PROCUREMENT INPUTS

CARD LIMIT = 75

Input Format	Hardware ID#	Class	Name of Hardware Type	Number of Units of Hardware Required in Year Z: Z=1	Z=2	Z=3	Z=4	Z=5	Cost Per Unit ($)	Stock Fund Item	Credit/Residual Value (%)	Contract Maintenance Cost Per Unit per Year ($)	Annual Attrition Rate (%)	Miscellaneous Repair Part Cost per Unit per Year ($)	Initial Stock Requirement (Months)
7	12	2	AN/URN-5 LF BEACON	1	5	5	5	1	1130		0	0	0	110	1
7	22	1	TEST SET 1	1	5	5	5	1	5281	1	60	0	0	53	1
7	32	1	TEST SET 2	1	5	5	5	1	5001	1	60	0	0	50	1
7	42	1	SIGNAL GENERATOR	1	5	5	5	1	3681	1	60	0	0	37	1
7	51	3	OVERHEAD PROJECTOR	2	3	3	3	2	2101	1	60	0	7	27	1
7	61	1	ASV TEACHING MACHINE	6	9	9	6	6	4501	1	60	0	10	45	1
7	71	1	SV TEACHING MACHINE	8	10	12	10	8	12001	1	60	0	10	120	1
7															
7															
7															
7															
7															
7															
7															
7															
7															
7															
7															

Each hardware type gets unique ID# in range 1 thru 99.

1 = media hardware
2 = special equipment
3 = overhead hardware

Enter "1" if stock fund item; otherwise leave blank.

to those presently being procured, other sources are referenced. Media hardware costs may be found in *The Audio-Visual Equipment Directory*[7] (see Table 7) and the *Handbook and Catalog for Instructional Media Selection*.[8] Developing a table of unit costs for special and overhead equipment was not possible, however, because of the wide range of possible items. Costs of special equipment may be obtained from a manufacturer or the cognizant base maintenance group. Overhead equipment costs may be determined by consulting Air Force, Defense Supply Agency, or General Services Administration Supply manuals.

Column 59 (1-column numeric field). Stock Fund item: designator (yes = 1; no = blank) to identify hardware obtained from the Air Force Stock Fund. Generally speaking, a piece of hardware will be a Stock Fund item if it is of relatively low value (say under $1000) *or* if it is in general use (that is, if it can be used by more than one training course). (Stock Fund items are normally procured from the O&M appropriation, while non-Stock Fund items are normally procured from one of the three major procurement appropriations.)

Columns 60-62 (3-column numeric field). Credit/residual value (percent): credit or residual value[9] of hardware item expressed as percentage of original cost. For Stock Fund items the amount of the credit is usually 60 percent of the original purchase price, the remaining 40 percent being assumed to go into rehabilitation action so that the equipment may again be "sold" at the full purchase price. No generalizations can be made regarding non-Stock Fund hardware.

Columns 63-68 (6-column numeric field). Contract maintenance cost per unit per year ($): cost of any hardware maintenance performed by a private contractor. Note that this cost element may subsume both the repair part and manpower cost elements (Format 8).

Columns 69-71 (3-column numeric field). Annual attrition rate (percent): the percentage of hardware units which will need replacement each year. This value can be approximated by multiplying the reciprocal of the estimated average life (in years) by 100. Unfortunately, average-life factors for instructional hardware are difficult to obtain. Furthermore, even when they can be obtained, they are subject to wide variance, because of differences in operating time, operating personnel, transportation, security, and the quality of the maintenance program. For media hardware, the values provided in Table 8 may be used as a guide. For special equipment, the manufacturer or a cognizant base maintenance group should be consulted. For overhead hardware, an average life expectancy of 20 years is probably not unreasonable.

Columns 72-77 (6-column numeric field). Miscellaneous repair-part cost per unit per year ($): the annual cost of purchasing repair parts for a single unit. In the absence of better data, a value in the range of 6 to 10 percent of the unit procurement cost should be used.

Columns 78-80 (3-column numeric field). Initial stock requirement (months): size of repair-parts stockpile expressed in months. One month is usually considered adequate for most types of instructional hardware.

[7] *The Audio-Visual Equipment Directory*, National Audio-Visual Association, Inc., Fairfax, Va., published annually.

[8] Brian G. Boucher et al., *Handbook and Catalog for Instructional Media Selection*, Educational Technology Publications, Englewood Cliffs, N. J., 1974.

[9] See p. 10.

Table 7

Unit Costs of Selected Media Hardware Types

Medium	Hardware Type[a]	Price Range ($)	Average Price ($)
AMV	Sound motion picture projectors and viewers		
	Individual viewer	175-500	335
	Classroom Projector	145-1,000	510
	Large classroom or small auditorium projector	710-1,350	990
	Auditorium projector	670-3,[illegible]85	2,160
	Variable speed viewer	2[illegible]-495	410
	Videotape recorders and players		
	Monochrome (1/2-in. tape)	595-2,250	1,220
	Monochrome (1-in. tape)	1,650-5,950	3,465
	Color (1/2- or 3/4-in. tape)	875-1,745	1,310
	Color (1-in. tape)	2,150-8,000	5,340
	Video projectors		
	Monochrome, low cost	3,000-7,800	4,350
	Monochrome, high cost	11,000-20,000	20,500
	Color	16,500-43,000	32,510
	Video monitors and receivers		
	Monochrome, individual monitor	165-335	245
	Monochrome, group receiver and/or monitor	130-445	230
	Monochrome, classroom receiver and/or monitor	195-630	330
	Color, group receiver and/or monitor	550-745	615
	Color, classroom receiver and/or monitor	480-850	640
ASV	Sound filmstrip projectors and viewers		
	Individual viewer	100-365	235
	Group projector	125-490	285
	Classroom projector	315-500	385
	Sound slide projectors and viewers, 2 in. by 2 in.		
	Individual and group projector and viewer	280-795	445
	Classroom projector	330-995	505
	Individual audio still visual teaching machines		
	Learner control of rate of presentation	235-995	450
	Learner control of content of presentation	1,950	1,950
	Machine control of rate of presentation	295-795	510
MV	Silent motion picture projectors and viewers		
	Individual viewer	175	175
	Classroom projector	145-255	190
SV	Silent filmstrip projectors and viewers		
	Individual viewer, low cost	25-90	50
	Individual viewer, high cost	225-400	310
	Group projector	40-145	65
	Classroom projector	65-265	135
	Silent slide projectors and viewers, 2 in. by 2 in.		
	Individual viewer	85-110	100
	Classroom projector	40-890	320
	Large classroom or small auditorium projector	530-1,530	795
	Auditorium projector	3,500-3,975	3,740
	Random access slide projectors		
	Classroom projector	500-1,915	1,870
	Auditorium projector	1,515-5,950	3,215
	Overhead projectors		
	Classroom	150-395	210
	Large classroom or small auditorium	255-900	580
	Auditorium	1,800-3,500	2,325
	Individual still visual teaching machine		
	Learner control of rate of presentation	140-375	270
	Learner control of content of presentation	220-825	565
	Machine control of rate of presentation	225-375	300
	Machine control of content of presentation	1,200	1,200
	Microform readers		
	Microfilm reader	370-770	615
	Microfiche reader	80-600	235
A	Audio disc players, monaural	55-325	115
	Audiotape recorders and players, monaural		
	Reel-to-reel, classroom	165-280	215
	Cassette, individual	30-85	70
	Cassette, classroom	140-290	200
	Individual audio teaching machine with learner control of rate of presentation	186-470	328
Other	Study carrel	95-330	166
	Terminal for student response		
	Hard copy display	985-4,995	3,400
	Cathode ray tube	720-9,000	3,640
	Group response monitor	720-3,656	2,190

NOTE: This data has been drawn, with permission, from *The Audio-Visual Equipment Directory*. Two qualifications need to be made of the data given here: first, the items of equipment may not be up to military specification; second, price discounts may be available on large-volume purchases.

[a]Characteristics of these typical models may be found in Appendix B.

Table 8

Average Life of Selected Media Hardware Types
(In years)

Hardware Type	*BAVI Values*[a]	*Air Force Values*
16-mm sound motion picture projector	6	15
Slide projector, manual, 2 in. by 2 in.	10	15
Slide projector, automatic, 2 in. by 2 in.	6	
Overhead projector	10	15
Filmstrip projector		20
Videotape projector		20
Tape recorder, reel-to-reel	5	
Tape recorder, cassette, heavy duty	5	
Tape recorder, cassette, light duty	2	
Phonograph, portable	3	
Television receiver	5	
Radio	5	

[a]Average-life figures compiled by the Bureau of Audio-Visual Instruction (BAVI) of the New York City Board of Education.

Format 8: Hardware Maintenance Manpower Inputs

Hardware maintenance personnel are responsible for the preventive and corrective maintenance of course hardware. Media hardware maintenance is generally the responsibility of the Training Services Division (school level), while all other types of hardware are usually serviced by the base Maintenance and Supply Group or a specialized maintenance squadron.

Columns 3-4 (2-column numeric field). Hardware ID number: the number used to identify the same hardware type on Format 7. A Format 8 card will be deleted if its ID number does not have a match on a Format 7 card or if its ID number duplicates that of another Format 8 card. Hardware maintenance manpower which is *thruput* may be aggregated and entered under a single existing Format 7 ID number if the user does not wish to make a separate entry for each individual hardware type.

Columns 5-6 (2-column numeric field). Input method: option to calculate (=1) or thruput (=2) the number of hardware maintenance man-years associated with a given hardware type.[10] Failure to enter a value of 1 or 2 will result in card deletion and the exclusion of that particular hardware's manpower and manpower-related cost from the output. Additionally, entries made in columns not encompassed by the designated input method are disregarded by the MODCOM program.

Columns 7-26 (five 4-column numeric fields). Average daily utilization rate per unit (in hours) in year Z (Worksheet 5).

Columns 27-32 (6-column numeric field). Number of failures per hour of use: the average number of times a particular type of equipment can be expected to fail for each hour of use. Some typical values are provided in Table 9.

Columns 33-37 (5-column numeric field). Average time to repair per failure (in hours). This value should include only that portion of down time in which maintenance personnel are actively pursuing the repair activity. It should *not* include the

[10] The hardware maintenance manpower estimating relationship used in conjunction with the calculation option is provided on p. 90.

INPUT FORMAT 8: HARDWARE MAINTENANCE MANPOWER INPUTS

CARD LIMIT = 75

Input Format	Hardware ID#	Input Method	Method 1: Calculation							Method 2: Thruput				
			Average Daily Utilization Rate per Unit in Year Z (hours)					Number of Failures Per Hour of Use	Average Time to Repair per Failure (Hours)	Number of Hardware Maintenance Man-years in Year Z				
			Z=1	Z=2	Z=3	Z=4	Z=5			Z=1	Z=2	Z=3	Z=4	Z=5
8	1	1	.94	1.16	1.37	1.16	.94	.007	7.5					
8	2	1	.94	1.16	1.37	1.16	.94	.005	3.0					
8	3	1	.94	1.16	1.37	1.16	.94	.005	3.0					
8	4	1	.94	1.16	1.37	1.16	.94	.005	3.5					
8	5	1	.96	.991	1.02	.992	.96	.0111	2.0					
8	6	1	.43	.40	.36	.40	.43	.0083	3.5					
8	7	1	.67	.80	.94	.80	.67	.0083	3.5					
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8														
8														
8														

1 = Calculation
2 = Thruput

Hardware ID numbers used on this format must have corresponding ID# on format 7.

interval between the time the failure is first reported and the time the maintenance action begins. Some typical values are provided in Table 9.

Columns 38-57 (five 4-column fields). Number of hardware maintenance man-years in year Z.

Table 9

Failures per Hour and Average Repair Times for Selected Types of Media Hardware[a]

Hardware Type	*Number of Failures per Hour of Use*	*Average Repair Time per Failure (hours)*
Sound reel-to-reel projector	.0088-.0111	3.5
Videotape projector	.0111	4.0
Filmstrip projector	.0067	2.0
Slide projector	.0111	3.0
Overhead projector	.0111	2.0

[a]If an appropriate analog cannot be found in this table, the Training Services Division (media hardware) or the Maintenance and Supply Group (all other hardware) should be consulted. Degree of complexity and number of moving parts are good indexes for determining analogs.

Format 9: Facility Procurement Inputs

This card contains inputs relating to the modification and construction of course facilities.

Columns 3-4 (2-column numeric field). Facility ID number: unique number in range 1 through 99 assigned by the user to each facility type. A card will be deleted if its ID number duplicates that of another card or falls outside the prescribed range.

Columns 5-34 (30-column alpha-numeric field). Name of facility type: user-selected name for identifying each facility type (Worksheet 6).

Columns 35-54 (five 4-column numeric fields). Number of units of facility required in year Z (Worksheet 6).

Columns 55-62 (8-column numeric field). Cost per unit ($): either the cost of construction, if the facility is to be newly built, or the imputed value[11] plus modification costs, if the facility already exists.

New Construction

Factors for estimating facility construction costs are provided in detail in AFP 88-16, *Military Construction Pricing Guide.*[12] For rough estimates, $25 per square foot may be used for such facilities as classrooms, hangars, and libraries; $35 per square foot for theaters; and $40 per square foot for photo labs and precision-measurement-equipment labs. These values are intended to include the entire cost

[11] See p. 9.

[12] Department of the Air Force, Headquarters USAF, *Military Construction Pricing Guide*, AFP 88-16, Washington, D.C.

INPUT FORMAT 9: FACILITY PROCUREMENT INPUTS

CARD LIMIT = 25

Input Format	Facility ID #	Name of Facility Type	Number of Units of Facility Required in Year Z					Cost per Unit * ($)	Residual Value (%)
			Z=1	Z=2	Z=3	Z=4	Z=5		
9	1	CLASSROOM 1	2	2	2	2	2	0	0
9	2	CLASSROOM 2	1	2	2	2	1	0	0
9	3	CLASSROOM 3	1	1	1	1	1	0	0
9	4	LAB	1	1	1	1	1	2000	0
9									
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9									

Each facility type gets unique ID# in range 1 thru 99.

*NOTE: *The assumption is made that these facilities have no alternative use (that is, no imputed value) and that only the lab requires modification.*

of a facility and everything permanently attached to it—all plumbing, wiring, heating, air conditioning, and masonry. Dimensions of typical classroom and laboratory facilities are as follows:

Facility Type	*Dimensions (feet)*	*No. of Students*
Classroom	22 by 26	12 to 14
Laboratory	22 by 26	6
Combination classroom/laboratory	30 by 30	12 to 15

Modification

New facilities are almost never constructed to accommodate the space requirements of a single course; existing space is usually modified. Some of the more frequent modifications are relocating walls, power outlets, and lighting, and adding air conditioning or false floors. Since rules-of-thumb for estimating facility modification costs do not exist, the planner should consult the Civil Engineering Squadron for an estimate or treat the new construction rules-of-thumb as upper bounds.

Columns 63-65 (3-column numeric field). Residual value (percent): residual value[13] of facility unit expressed as percentage of original cost.

Format 10: Facility Maintenance Manpower Inputs

Facility maintenance personnel, organizationally part of the Civil Engineering Squadron, are responsible for maintaining and repairing course facilities (custodial service is normally provided by student details).[14]

Columns 3-4 (2-column numeric field). Facility ID number: The number used on Format 9 to identify the facility type. A Format 10 card will be deleted if its ID number does not have a match on a Format 9 card or if its ID number duplicates that of another Format 10 card. Facility maintenance manpower which is *thruput* may be aggregated and entered under a single existing Format 9 ID number if the user does not wish to make a separate entry for each individual facility type.

Columns 5-6 (2-column numeric field). Input method: option to calculate (=1) or thruput (=2) the number of facility maintenance man-years associated with a given facility type.[15] Failure to enter a value of 1 or 2 will result in card deletion and the exclusion of that particular facility's manpower and manpower-related costs from the output. Additionally, entries made in columns not encompassed by the designated input method are disregarded by the MODCOM program.

Columns 7-13 (7-column numeric field). Square feet per facility unit.

Columns 14-19 (6-column numeric field). Maintenance man-hours (MMH) per square foot per month. A typical value is on the order of .00001 MMH per square foot per month.

Columns 20-44 (five 5-column numeric fields). Number of facility maintenance man-years in year Z.

[13] See p. 10.

[14] The allocation of facility maintenance personnel to a course is a somewhat tenuous proposition since the required maintenance and/or repair action would be done whether or not a particular course is given. However, the final decision on the inclusion of this manpower type is left to the planner.

[15] The facility maintenance manpower estimating relationship used in conjunction with the calculation option is provided on p. 90.

INPUT FORMAT 10: FACILITY MAINTENANCE MANPOWER INPUTS

CARD LIMIT = 25

Input Format	Facility ID #	Input Method	Method 1: Calculation		Method 2: Thruput				
			Square Feet per Facility Unit	Maintenance Man-hours per Square Foot per Month	Number of Facilities Maintenance Man-years in Year Z				
					Z=1	Z=2	Z=3	Z=4	Z=5
01 02	03 04	05 06	07 08 09 10 11 12 13	14 15 16 17 18 19	20 21 22 23 24	25 26 27 28 29	30 31 32 33 34	35 36 37 38 39	40 41 42 43 44
10	1	1	5 7 2	0					
10	2	1	5 7 2	0					
10	3	1	5 7 2	0					
10	4	1	5 7 2	0					
10									
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10									

45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

1 = Calculation
2 = Thruput

Facility ID numbers used on this format must have corresponding ID # on format 9

NOTE: *All facility maintenance is assumed to be handled by student details. Therefore, the maintenance man-hour value is zero.*

Format 11: Training Administrative, Base Operating Support, and Medical Manpower Inputs

This card contains inputs required for the derivation of training administrative manpower, base-operating support manpower, and medical manpower.

Training administrative personnel perform training-related overhead functions not otherwise accounted for. These include functions at the school level (Administrative Division, Training Evaluation Division, Operations Division, and Foreign Military Affairs Office), at the department level (Administrative Section, Requirements Unit, and Instruction and Measurement Unit), and at the branch level (branch administration). It does not, however, include the functions provided by the Training Services Division or the Instructor Training Division (school level) or the Curricula Unit (department level).

Base operating support personnel perform the following service functions on the base: supply, transportation, security policy, financial control, personnel services, food, commissary, housing, laundry and dry cleaning, recreation, education, transient aircraft maintenance, and general base maintenance.

Medical personnel provide medical and dental care to military personnel.

Columns 3-4 (2-column numeric field). Personnel type: numeric personnel type code as follows:

13 = Training Administrative
14 = Base Operating Support
15 = Medical

Columns 5-6 (2-column numeric field). Input method: option to calculate (=1) or thruput (=2) the number of man-years associated with each personnel type.[16] Failure to enter a value of 1 or 2 will result in card deletion and the exclusion of that particular personnel type's manpower and manpower-related cost from the output. Additionally, entries made in columns not encompassed by the designated input method are disregarded by the MODCOM program.

Columns 7-21 (three 5-column numeric fields). Fixed man-years per course, variable man-years per type A man-year, and variable man-years per type B man-year, respectively. Suggested values are as follows:

	Fixed Man-years per Course	*Variable Man-years per Type A Man-year*	*Variable Man-years per Type B Man-year*
Training administrative	3	.05	—
Base operating support	0	.08	.035
Medical	0	.02	.005

where Type A and Type B man-years are defined as follows:

Training Administrative Personnel

Type A man-years = student man-years + instructor man-years + curriculum man-years

[16] The training administrative, base operating support, and medical manpower estimating relationships used in conjunction with the calculation option are provided on p. 91 ff.

INPUT FORMAT 11: TRAINING ADMINISTRATIVE, BASE OPERATING SUPPORT, AND MEDICAL MANPOWER INPUTS — CARD LIMIT = 3

Input Format	Personnel Type	Input Method	Method 1: Calculation			Method 2: Thruput						
			Fixed Man-years per Course*	Variable Man-years per Type A Man-year	Variable Man-years per Type B Man-year	Number of Training Administrative Man-years, Base Operating Support Man-years, Medical Man-years in Year Z						
						Z=0	Z=1	Z=2	Z=3	Z=4	Z=5	
01 02	03 04	05 06	07 08 09 10 11	12 13 14 15 16	17 18 19 20 21	22 23 24 25 26	27 28 29 30 31	32 33 34 35 36	37 38 39 40 41	42 43 44 45 46	47 48 49 50 51	52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
1 1	1 3	1	0	.0 5	XXXXX							
1 1	1 4	1	0	.0 0	.0 3 5							
1 1	1 5	1	0	.0 2	.0 0 5							

1 = Calculation
2 = Thruput

13 = Training Administrative
14 = Base Operating Support
15 = Medical

NOTE: Since the MODIA Sample Case represents only a portion (block) of the training course, no fixed training administrative man-years are entered.

Base Operating Support Personnel

Type A man-years = PCS (permanent change of station) student man-years + base permanent party man-years

and

Type B man-years = TDY (temporary duty) student man-years

Medical Personnel

Type A man-years = military PCS student man-years + military base permanent party man-years

and

Type B man-years = military TDY student man-years

Columns 22-51 (six 5-column numeric fields). Number of support personnel man-years in year Z.

Format 12: Computer Service Charge Inputs

Columns 3-32 (five 6-column numeric fields). Computer service changes in year Z ($): any computer expenses, not accounted for elsewhere, that are incurred as a result of using computer-assisted instruction. Two possibilities exist:

- *Course-Specific.* Computer hardware obtained specifically for a given course may either be purchased or leased. If purchased, the procurement and maintenance costs should be accounted for on Format 7 and Format 8 cards, leaving only residual operating costs for the Format 12 card. If leased, then lease costs, maintenance costs (if not included in the lease charge), and operating costs should be entered on the Format 12 card.
- *General Purpose.* ATC does not allocate the costs of base-wide general purpose computers to the various users, but this does not mean that these costs should be ignored. Unfortunately, because of the wide range of possible computer systems and of methods for allocating computer costs, no rule-of-thumb procedures for estimating computer charges could be developed. However, if it is not possible to represent computer use in dollar terms, the planner is advised to select some other measure of resource utilization (e.g., CPU seconds, number of core bytes used) and keep track of utilization outside the formal structure of the Cost Model.

Format 13: Optional Officer/Airman/Civilian Distribution Overrides

This card provides the planner the option of overriding stored officer/airman/civilian distribution percentages. It is one of two input formats on which blanks and zeros are differentiated. Thus, the planner needs to make entries only in the fields of those types of personnel whose distribution he wishes to override; the other fields should be left blank. If the override values for a given personnel type do not total 100, then the model reinstates the stored values. The stored values are as follows:

INPUT FORMAT 12: COMPUTER SERVICE CHARGE INPUTS — CARD LIMIT = 1

Input Format	Computer Service Charges in Year Z ($)				
	Z=1	Z=2	Z=3	Z=4	Z=5

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
1	2			

INPUT FORMAT 13: OPTIONAL OFFICER/AIRMAN/CIVILIAN DISTRIBUTION OVERRIDES

CARD LIMIT = 1

Input Format	Curriculum			Hardware Maintenance			Facility Maintenance			Training Administrative			Base Operating Support			Medical		
	Off % (0)	Amn % (63)	Civ % (37)	Off % (2)	Amn % (72)	Civ % (26)	Off % (0)	Amn % (100)	Civ % (0)	Off % (6)	Amn % (39)	Civ % (55)	Off % (2)	Amn % (64)	Civ % (34)	Off % (20)	Amn % (80)	Civ % (0)
01 02 03 04 05 06 07 08 09 10 11	12 13 14	15 16 17	18 19 20	21 22 23	24 25 26	27 28 29	30 31 32	33 34 35	36 37 38	39 40 41	42 43 44	45 46 47	48 49 50	51 52 53	54 55 56	57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80		
1 3																		

Default values are contained in parentheses

Personnel Type	*Percent Officers*	*Percent Airmen*	*Percent Civilians*
Curriculum	0	63	37
Hardware maintenance	2	72	26
Facility maintenance	0	100	0
Training administrative	6	39	55
Base operating support	2	64	34
Medical	20	80	0

Columns 3-11 (three 3-column numeric fields). Curriculum manpower officer/airman/civilian distribution.

Columns 12-20 (three 3-column numeric fields). Hardware maintenance manpower officer/airman/civilian distribution.

Columns 21-29 (three 3-column numeric fields). Facility maintenance manpower officer/airman/civilian distribution.

Columns 30-38 (three 3-column numeric fields). Training administrative manpower officer/airman/civilian distribution.

Columns 39-47 (three 3-column numeric fields). Base operating support manpower officer/airman/civilian distribution.

Columns 48-56 (three 3-column numeric fields). Medical manpower officer/airman/civilian distribution.

Format 14: Optional Miscellaneous Overrides

This card allows the planner to override miscellaneous time and cost factors which have been stored as part of the program. It is the second of two input formats on which blanks and zeros are differentiated. Thus, as before, the planner needs to make entries only in the fields of those factors which he wishes to override; the other fields should be left blank. The stored values are as follows:

Input Factor	*Value*
Available productive man-hours/month	
Hardware maintenance personnel	122
All other personnel types	144
Average number of training days per month	20.99
Classroom training hours per student per day	6
Miscellaneous supply cost per man-year ($)	112
PCS cost per move ($)	
Instructors	
Officer	1913
Airman	1118
Civilian	1913
Students	
Officer	1098
Airman	480
Civilian	1098
TDY expense ($)	
One-way transportation	85
Destination per diem	
Officer	11
Airman	4
Civilian	21
Discount rate (percent)	10

INPUT FORMAT 14: OPTIONAL MISCELLANEOUS OVERRIDES

CARD LIMIT = 1

Input Format	Available Productive Man-hours per Month		Average No. of Training Days per Month (20.99)	Classroom Training Hours per Student per Day (6)	Miscellaneous Supply Cost per Man-year ($) (112)	PCS Cost/Move ($)						TDY Expense ($)				Discount Rate (%) (10)	
						Instructor			Student*				Destination Per Diem				
	Hardware Maint. (122)	All Other (144)				Off (1913)	Amn (1118)	Civ (1913)	Off (1098)	Amn (480)	Civ (1098)	Average One-Way Transp. Cost ($) (85)	Off (11)	Amn (4)	Civ (21)		
01 02	03 04 05 06	07 08 09 10	11 12 13 14	15 16 17 18	19 20 21 22 23	24 25 26 27	28 29 30 31	32 33 34 35	36 37 38 39	40 41 42 43	44 45 46 47	48 49 50 51	52 53 54	55 56 57	58 59 60	61 62	63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
1 4									0		0	0					

Default values are contained in parentheses.

*NOTE: *Student PCS costs are set equal to zero because these costs should be charged to the entire 35 week training period and not just the one week block costed in the MODIA Sample Case.*

Columns 3-10 (two 4-column numeric fields). Available productive man-hours per month. Most AF training personnel have 144 hours per month available for productive work (168 assigned hours less 24 hours for organizational duties, other kinds of training, medical care, and leave). Hardware maintenance personnel, however, must spend part of that 144 hours waiting for parts and tools. This waiting time is estimated at 15 percent of available hours; this reduces the available productive man-hours per month of hardware maintenance personnel to 122.

Columns 11-14 (4-column numeric field). Average number of training days per month.

Columns 15-18 (4-column numeric field). Classroom training hours per student per day. This value should coincide with the value listed on Worksheet 1.

Columns 19-23 (5-column numeric field). Miscellaneous supply cost per man-year: the cost of personnel supplies (food, clothing, etc.) and general office supplies (paper, pencils, forms, etc.) per man-year (students and permanent party).

Columns 24-47 (six 4-column numeric fields). PCS cost per move ($): includes transportation of personnel and dependents; shipment and/or storage of household goods; and mileage, per diem, and subsistence allowance while in travel status.

Columns 48-51 (4-column numeric field). Average TDY one-way transportation cost ($): average cost of transportation and travel per diem to or from technical training center.

Columns 52-60 (three 3-column numeric fields). TDY destination per diem ($): average student cash entitlement while at technical training centers, after deductions for quarters and messing (when available).

Columns 61-62 (2-column numeric field). Discount rate (percent).

Format 15: Optional Pay and Allowance Overrides

This card permits the planner to override the stored pay and allowance factors. The stored values are listed starting on p. 41.

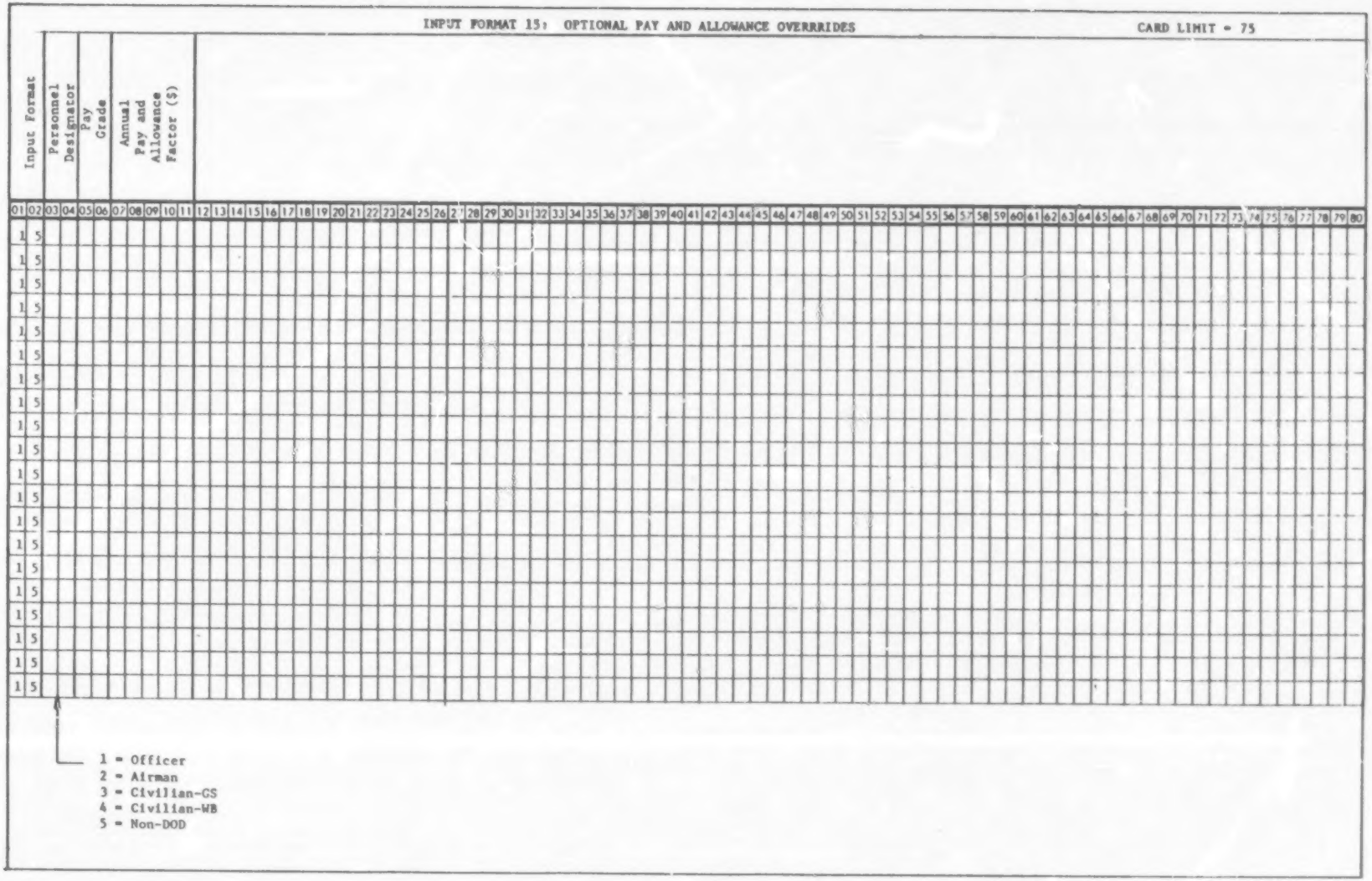
Columns 3-4 (2-column numeric field). Personnel designator: numeric personnel designator code as follows:

1 = Officer
2 = Airman
3 = Civilian–GS
4 = Civilian–WB
5 = Non-DoD

Use of a code outside the range 1 through 5 will result in the deletion of that card.

Columns 5-6 (2-column numeric field). Pay grade: standard U.S. Government numeric pay-grade codes. Card deletion will occur if the pay grade entered is not within the range of permissible pay grades for that personnel designator or if the personnel designator/pay-grade combination duplicates that of another card.

Personnel Designator	*Permissible Pay Grade Range*
1 = Officer	0 or blank, 1-10
2 = Airman	0 or blank, 1-9
3 = Civilian, GS	0 or blank, 1-18
4 = Civilian, WB	0 or blank, 1-14
5 = Non-DoD	0 or blank, 1-20


INPUT FORMAT 15: OPTIONAL PAY AND ALLOWANCE OVERRRIDES
CARD LIMIT = 75
Input Format
Personnel Desigmator
Pay Grade
Annual Pay and Allowance Factor ($)
01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
1 5
1 = Officer
2 = Airman
3 = Civilian-GS
4 = Civilian-WB
5 = Non-DOD

Columns 7-11 (5-column numeric field). Annual pay and allowance factor ($): annual pay and allowances per man-year.

Format 99: Termination Card

No entry beyond the "99" in columns 1 and 2 needs to be made.

B. TYPICAL VALUE SOURCES

The following list identifies the source of each typical value presented in this section.

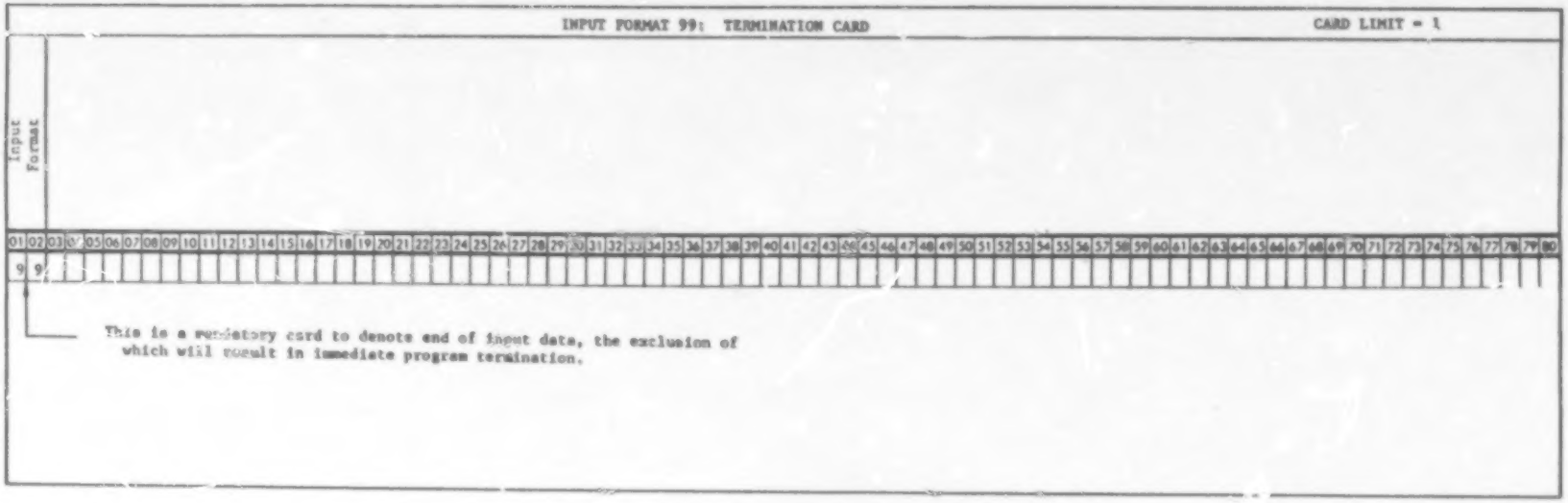
Format Number		Source
3	Student pay grades (Table 3)	1
3	Military and civilian pay and allowance factors	2
4	Instructor pay grades (Table 4)	1
4	Number of months instructors on-board in year 0	1
4	Instructor turnover rates	1
4	Cost of initial factory training of instructors	1
4	Cost of instructor education training	1
5	Rules of thumb for estimating courseware procurement costs (Table 5)	1
5	Courseware packaging costs	3
5	Annual courseware revision rate	1
5	Courseware useful-life estimates	1
6	Initial-development curriculum man-hours per classroom instruction hour (Table 6)	1
6	Percent of curriculum development accomplished by instructors	1
7	Media hardware procurement costs (Table 7)	4
7	Stock fund residual value percentage	5
7	Media hardware average-life estimates (Table 8)	1,6
7	Miscellaneous repair part percentage	3
7	Initial stock requirement	1
8	Media hardware failure rates and repair times (Table 9)	1
9	Rules of thumb for estimating facility construction costs	3
9	Facility dimensions and capacities	1
10	Facility maintenance man-hours per square foot per month	3
11	Fixed and variable manpower factors for training administrative, base operating support, and medical personnel	7
13	Officer/airman/civilian distribution percentages	
	Curriculum, hardware maintenance, and training administrative	3
	Base operating support, facility maintenance and medical	7
14	Available productive man-hours/month	
	Hardware maintenance	3
	All other personnel	7
14	Average number of training days per month	7
14	Classroom training hours per student per day	7
14	Miscellaneous supply cost per man-year	3

14	PCS cost per move	2
14	TDY expense	8
14	Discount rate	9

SOURCES:

1. Keesler Technical Training Center, Keesler AFB, Mississippi
2. *USAF Cost and Planning Factors*, AFR 173-10, Department of the Air Force, Headquarters USAF, Washington, D.C.
3. Rand-derived estimate(s)
4. Rand estimates based on data in *The Audio-Visual Equipment Directory*, National Audio-Visual Association, Inc., Fairfax, Va.
5. Comptroller, Headquarters ATC, Randolph AFB, Texas
6. EPIEGRAM (Newsletter of the Educational Products Information Exchange Institute, N.Y.), No. 13, April 1, 1973
7. DCS Plans, Directorate of Manpower and Organization, Headquarters ATC, Randolph AFB, Texas
8. *ATC Cost Factors Summary*, Department of the Air Force, Headquarters ATC, Randolph AFB, Texas
9. OMB Circular No. A-94, "Discount rates to be used in evaluating time-distributed costs and benefits," March 27, 1972, Office of Management and Budget, Washington, D.C.

INPUT FORMAT 99: TERMINATION CARD — CARD LIMIT = 1



IV. OUTPUT STRUCTURE

The purpose of this section is to provide a brief description of the MODCOM output structure. A sample case starts on p. 79: Printout 7 is a card-image listing of the input data; Printouts 8 and 9 show the cost factors stored as part of the model; and Printouts 10 through 14 represent the MODCOM output. (Some definitions previously given are repeated here so that the reader will not have to refer back to earlier sections.)

A. OUTPUT 1: GRADUATE SUMMARY (Printout 10)

Output 1 is a time-phased summary of Active Duty Force, Guard and Reserve, Other DoD, and Non-DoD graduates. The numbers reflect only those students who actually graduate in that year. If the course lasted longer than one year, no graduates would appear for year 1. The *In Progress* column indicates the number of students entering during but graduating after the five-year MODCOM period. All Air Force students, except those assigned to the Air National Guard and the Air Force Reserve, are termed *Active Duty Forces. Guard and Reserve Forces* refers only to Air Force Guard and Reserve students. Students assigned to DoD agencies other than the AF, such as the Army and Navy (including their Guard and Reserve components) are classified as *Other DoD.* Finally, students from non-DoD agencies and from foreign governments (e.g., under the Military Assistance Program) are termed *Non-DoD.*

The washout rate, which the user can calculate from Output 1 (washouts * 100/entrants), may not exactly match the input washout rate due to the model's rounding routine.

B. OUTPUT 2: MANPOWER SUMMARY (Printout 11)

Output 2 is a two-part, time-phased summary of student and base permanent party man-years. Part 1 is a functional breakdown covering all course personnel; Part 2 is a PCS/TDY breakdown of AF personnel.

Part 1—Functional Breakdown Covering All Course Personnel

Total Student Load is the total student man-years.

Instructors include all academic, remedial, and special requirements instructors and also course supervisors.

Curriculum Personnel determine training requirements and develop course written materials. Normally attached to the Curricula Unit of a training department, curriculum personnel share the task of courseware development with the course's instructors.

Hardware Maintenance Personnel are responsible for the preventive and corrective maintenance of course hardware. Media hardware maintenance is generally the responsibility of the Training Services Division (school level), while all other

types of hardware are usually serviced by the base Maintenance and Supply Group or a specialized maintenance squadron.

Facilities Maintenance Personnel, organizationally part of the Civil Engineering Squadron, are responsible for the maintenance and repair of *course-related* facilities.

Training Administrative Personnel perform training-related overhead functions not otherwise accounted for. These include functions at the school level (Administrative Division, Training Evaluation Division, Operations Division, and Foreign Military Affairs Office), at the department level (Administrative Section, Requirements Unit, and Instruction and Measurement Unit), and at the branch level (branch administration). They do not, however, include the functions provided by the Training Services Division or the Instructor Training Division (school level) or the Curricula Unit (department level).

Base Operating Support Personnel perform the following service functions on the base: supply, transportation, security police, financial control, personnel services, food, commissary, housing, laundry and dry cleaning, recreation, education, transient aircraft maintenance, and general base maintenance.

Medical Personnel provide medical and dental care to military personnel.

Total Base Permanent Party represents personnel assigned to a base to further the mission of that base. Students are excluded from this total.

Total Course Man-Years is the total student load plus total base permanent party.

Part 2—PCS/TDY Breakdown of AF Personnel

Active Duty Force PCS Student Load is the number of PCS man-years accrued by Active Duty Force students. Pipeline students are always assumed to be PCS; lateral and upgrade students are PCS only if the course lasts 20 weeks or more.

Air Force Base Permanent Party is the total AF base permanent party (excludes non-AF instructors).

Total Program 8 Man-Years is the number of man-years charged to Air Force Program 8 (Training, Medical, and Other Personnel Activities), excluding man-years for Program 8 TDY students, who are accounted for in the Active Duty Force student load.

Active Duty Force TDY Student Load is the number of TDY man-years accrued by Active Duty Force students including Program 8 TDY students. Pipeline students are never TDY while lateral/upgrade students are TDY only if the course lasts less than 20 weeks. They may be assigned to any program element in Air Force Programs 1 to 4 and 6 to 10.

Guard and Reserve Student Load is the number of man-years (PCS and TDY) accrued by Air Force Guard and Reserve students. All Guard and Reserve man-years are charged to Program 5.

Total Air Force Man-Years is the sum of total Program 8 man-years, Active Duty Force TDY student man-years, and Guard/Reserve student man-years.

C. OUTPUT 3: COURSEWARE, HARDWARE, AND FACILITY REQUIREMENTS (Printout 12)

Output 3 is a recapitulation of key courseware, hardware, and facility inputs

(Section III). The courseware inputs are reproduced from Format 5; the hardware inputs from Formats 7 and 8; and the facility inputs from Formats 9 and 10.

D. OUTPUT 4: FUNCTIONAL COST SUMMARY (Printout 13)

Output 4 is a breakdown of total course costs by function.

Investment Costs

Courseware Procurement includes four separate costs: (1) the initial cost of producing the master from which all subsequent copies will be made; (2) the cost of reproducing and packaging the required number of copies; (3) the annual cost of revision due to changes in course content; and (4) the annual cost of replacement due to loss, damage, and normal wear. It does not include the cost of courseware development such as script writing and editing, which is accounted for within curriculum manpower pay and allowances.

Hardware Procurement embraces the following cost elements: (1) the cost of purchasing the incremental number of units required each year, including initial repair-part stocks; (2) credits for any surplus items returned to inventory; and (3) the annual cost of replacing those units worn out during the year. The annual cost of replenishment repair parts and contractual maintenance is accounted for elsewhere. Negative numbers indicate a dominance of inventory credits.

Facility Construction represents the total cost of constructing and/or modifying facilities for course use. Negative numbers indicate the residual value of facility units no longer required.

Operating Costs

Pay and Allowances provides for all officer, airman, and civilian pay and allowances. The elements accounted for are as follows:

Officers	Airmen	Civilian
Basic pay	Basic pay	Basic pay
Special pay	Special pay	Life insurance
Basic allowance for quarters	Proficiency pay	Health benefits
Basic allowance for subsistence	Reenlistment bonus	Terminal leave
Uniform allowance	Basic allowance for quarters	Workman's compensation
Family separation allowance	Clothing allowance	Civilian retirement
Separation payments	Separation payments	Overtime
Social security tax (employer's contribution)	Social security tax (employer's contribution)	

Incentive pay for hazardous duty (flight pay) and allowances for overseas duty and family separation are excluded because they are not characteristic of ATC technical training operations.

PCS Costs include the expenses incident to the permanent change of station of students and instructors: transportation of personnel and dependents; shipment and/or storage of household goods; and mileage, per diem, and subsistence allowances while in travel status.

TDY Costs include commercial transportation, car rental, allowances for mileage and tolls, per diem, and incidental expenses incurred by students in authorized travel status.

Instructor Training is composed of instructor education-training costs (the cost of the six-week instructor prerequisite course on education principles) and initial factory training costs (the cost of providing the initial instructor cadre with the necessary specialized equipment or system training).

Miscellaneous Operating Costs are of four distinct kinds:

1. Computer service charges: any computer expenses incurred as a result of using computer-assisted instruction.
2. Hardware contract maintenance: the cost of any hardware maintenance performed by a private contractor.
3. Hardware repair-part replenishment: the cost of purchasing miscellaneous repair parts for hardware.
4. Miscellaneous supplies: the cost of personnel supplies (food, clothing, etc.) and general office supplies (paper, pencils, forms, etc.).

E. OUTPUT 5: PROGRAM/APPROPRIATION COST SUMMARY (Printout 14)

Output 5 is a breakdown of total course costs by program and budget appropriation.[1] These appropriations are defined in terms of their functional cost elements in Table 10. In order to minimize the number of inputs, certain functional cost elements, which would normally be spread across several appropriation cost elements, were assigned to a single appropriation element; they are instructor factory training, instructor education training, courseware procurement, and computer service charges.

[1] For a detailed treatment of the entire budget process, see Department of the Air Force, Headquarters USAF (Comptroller), *The Air Force Budget*, published annually.

Table 10

Appropriation Cost Category Definition

Line	Appropriation Cost Category	Description in Terms of Functional Cost Elements
	Air Force	
	Program 8--Training, Medical, Other Personnel Activities	
1	Military Construction (3300)	Construction of facilities with a total cost for a given year of > $50,000 (see line 5)
	Operations and Maintenance (3400)	
2	Civilian Personnel	Pay of AF civilian instructors and other civilian base permanent party
3	Travel of Personnel	PCS costs of entering Active Duty Force civilian PCS students and arriving Active Duty Force civilian instructors (see line 18)
4	Printing and Reproduction	Procurement cost of courseware
5	Other Purchased Services	Costs of instructor education and factory training, computer services, hardware contract maintenance, and construction of facilities with a total cost for a given year of less than $50,000 (see line 1)
6	Other Supplies and Equipment	Procurement cost of Stock Fund hardware (see line 16), hardware replenishment repair parts, and miscellaneous supplies
	Military Personnel (3500)	
7	Officer Pay	Pay of Active Duty Force officer PCS students, AF officer instructors, and other officer base permanent party
8	Airman Pay	Pay of Active Duty Force airman PCS students, AF airman instructors, and other airman base permanent party
9	PCS	PCS cost of AF military instructors and Active Duty Force military PCS students
10	Total Program 8	Sum of lines 1 through 9
	Program 5--Guard and Reserve Forces	
	Operations and Maintenance--ANG/AFR (3840/3740)	
11	Civilian Personnel	Pay of Guard/Reserve civilian students
12	Civilian PCS/TDY	PCS and TDY costs of Guard/Reserve civilian students
	National Guard/Reserve Personnel (3850/3700)	
13	Officer Pay	Pay of Guard/Reserve officer students
14	Airman Pay	Pay of Guard/Reserve airman students
15	Active Duty Guard/Reserve PCS/TDY	PCS and TDY costs of Guard/Reserve military students
	Other Air Force Programs (1-4, 6, 7, 9, 10)	
16	Aircraft, Missile, Other Procurement (3010, 3020, 3080)	Procurement cost of non-Stock Fund hardware
	Operations and Maintenance (3400)	
17	Civilian Personnel	Pay of Active Duty Force civilian TDY students
18	Travel of Personnel	PCS cost of departing Active Duty Force civilian PCS students and departing Active Duty Force civilian instructors (see line 3) and TDY cost of Active Duty Force TDY students
	Military Personnel	
19	Officer Pay	Pay of Active Duty Force officer TDY students
20	Airman Pay	Pay of Active Duty Force airman TDY students
21	Total Air Force	Sum of lines 10 through 20
	Other DoD	
	Operations and Maintenance (3400)	
22	Civilian Personnel	Pay of other DoD civilian students and instructors
23	Travel of Personnel	PCS cost of other DoD civilian PCS students and TDY cost of other DoD TDY students
	Military Personnel	
24	Officer Pay	Pay of other DoD officer students and instructors
25	Airman Pay	Pay of other DoD airman students and instructors
26	PCS	PCS cost of other DoD military instructors and other DoD military PCS students
27	Non-DoD	Pay of Non-DoD students
28	TOTAL COURSE COST	Sum of lines 21 through 27

INPUT DATA

```
                1        2        3        4        5        6        7        8
      1         0        0        0        0        0        0        0        0
      ************************************************************************

 1.   1MODIA ILLUSTRATIVE EXAMPLE
 2.   2  30  15  31  30
 3.   3 1 2 11 403 604 806 604 403
 4.   4 8 2 5    4   7    4  4.5    5  4.5    4 33  3500 1096
 5.   4 8 3 9    0   0    2    2    2    2    2  5     0    0
 6.   4 8 311    0   0  .07   .1  .14   .1  .07  5     0    0
 7.   5 13TRANSPARENCIES (GRP A) SETTRANSP    1    2    2    1  195 7.45 .05    0 20  0
 8.   5 23TRANSPARENCIES (GRP B) SETTRANSP    2    3    3    2   15 7.45 .05    0 20  0
 9.   5 33TRANSPARENCIES (GRP C) SETTRANSP    1    1    1    1    1   15 7.45 .05  0 20  0
10.   5 43FILMSTRIP (GRP D)      FMSTFRAMES   5    7    9    7    5  105   30  .7    0 20  0
11.   5 53FILMSTRIP (GRP E)      FMSTFRAMES   5    7    8    7    5   13   30  .7    0 20  0
12.   5 63FILMSTRIP (GRP F)      FMSTFRAMES   4    5    6    5    4   13   30  .7    0 20  0
13.   5 73FILMSTRIP (GRP G)      FMSTFRAMES   6    7    9    7    6   53   30  .7    0 20  0
14.   5 83AUDIOTAPE (GRP H)      CASS   MIN   5    7    9    7    5  105    8  .1    0 20 50
15.   5 93AUDIOTAPE (GRP I)      CASS   MIN   5    7    8    7    5   13    8  .1    0 20 50
16.   5103AUDIOTAPE (GRP J)      CASS   MIN   4    5    6    5    4   13    8  .1    0 20 50
17.   5113AUDIOTAPE (GRP K)      CASS   MIN   4    7    8    7    6   53    8  .1    0 20 50
18.   5121PROGRAMMED TEXT        TEXT PAGES                          720 7.25.008    3 20  0
19.   5133FILMSTRIP (GRP M)      FMSTFRAMES   6    9   11    9    6   59 8.55 .35    0 20  0
20.   5143FILMSTRIP (GRP N)      FMSTFRAMES   8   10   12   10    8  216 8.55 .35    0 20  0
21.   5151TECH ORDERS            SETS PAGES   4    5    5    5   41300    0.008    3 20  0
22.   5161STUDY REFERENCES       SETS PAGES                          95 7.25.008    3 20  0
23.   5172LESSON PLANS           SETS PAGES                          20 7.25.008    3 20  0
24.   6 1 1  5.2  346 80
25.   6 2 1  5.2  208 80
26.   6 3 1  8.5    5 80
27.   6 4 1  4.0   90 80
28.   6 5 1  5.0 11.7 80
29.   6 6 1   30    5 80
30.   7 12AN/URN-5 LF BEACON          4   5   5   5   4   11300   0      0  0  1130  1
31.   7 22TEST SET 1                  4   5   5   5   4    5281 60      0  0    53  1
32.   7 32TEST SET2                   4   5   5   5   4    5001 60      0  0    50  1
33.   7 42SIGNAL GENERATOR            4   5   5   5   4    3681 60      0  0    37  1
34.   7 51OVERHEAD PROJECTOR          2   3   3   3   2    2101 60      0  7    21  1
35.   7 61ASV TEACHING MACHINE        6   8   9   8   6    4501 60      0 10    45  1
36.   7 71SV TEACHING MACHINE         8  10  12  10   8   12001 60      0 10   120  1
37.   8 1 1 .941.161.371.16 .94  .007  7.5
38.   8 2 1 .941.161.371.16 .94   .05  3.0
39.   8 3 1 .941.161.371.16 .94   .05  3.0
40.   8 4 1 .941.161.371.16 .94   .05  3.5
41.   8 5 1 .96 .991.02 .99 .96 .0111  2.0
42.   8 6 1 .43 .40 .36 .40 .43 .0083  3.5
43.   8 7 1 .67 .80 .94 .80 .67 .0083  3.5
```

MODIA Illustrative Example

INPUT DATA

```
                1         2         3         4         5         6         7         8
      1         0         0         0         0         0         0         0         0
      ....+....+....+
```

ANNUAL PAY RATES (FY 1975)

MILITARY PERSONNEL

PAY GRADE	ANNUAL RATE
O- 1	$10004.
O- 2	13681.
O- 3	17876.
O- 4	20624.
O- 5	24887.
O- 6	29384.
O- 7	33867.
O- 8	38385.
O- 9	40041.
O-10	43084.
O-AVG.	18297.
E- 1	5430.
E- 2	6027.
E- 3	6579.
E- 4	7791.
E- 5	9583.
E- 6	11261.
E- 7	12779.
E- 8	14638.
E- 9	17002.
E-AVG.	8551.

CIVILIAN PERSONNEL

PAY GRADE	ANNUAL RATE
GS- 1	$ 5651.
GS- 2	6447.
GS- 3	7953.
GS- 4	9266.
GS- 5	10483.
GS- 6	11782.
GS- 7	13128.
GS- 8	14254.
GS- 9	15717.
GS-10	17041.
GS-11	18935.
GS-12	22285.
GS-13	28053.
GS-14	30377.
GS-15	35823.
GS-16	39060.
GS-17	39060.
GS-18	39060.
GS-AVG.	1259*.
WR- 1	7912.
WR- 2	8491.
WR- 3	8896.
WR- 4	9214.
WR- 5	9587.
WR- 6	10527.
WR- 7	11077.
WR- 8	11471.
WR- 9	12124.
WR-10	12758.
WR-11	13373.
WR-12	13845.
WR-13	14776.
WR-14	15157.
WR-AVG.	11464.

FOREIGN STUDENTS

PAY GRADE	ANNUAL RATE
F- 1	0.
F- 2	0.
F- 3	0.
F- 4	0.
F- 5	0.
F- 6	0.
F- 7	0.
F- 8	0.
F- 9	0.
F-10	0.
F-11	0.
F-12	0.
F-13	0.
F-14	0.
F-15	0.
F-16	0.
F-17	0.
F-18	0.
F-19	0.
F-20	0.
F-AVG.	0.

* INDICATES USER OVERRIDE VALUE (IF ANY)

PROGRAM CONSTANTS

* INDICATES USER OVERRIDE VALUE (IF ANY)

OFFICER/AIRMAN/CIVILIAN DISTRIBUTION			
CURRICULUM			
OFF	0.		
AMN	63.		
CIV	37.		
HARDWARE			
OFF	2.		
AMN	72.		
CIV	26.		
FACILITY			
OFF	0.		
AMN	100.		
CIV	0.		
TRAINING ADMINISTRATIVE			
OFF	6.		
AMN	39.		
CIV	55.		
BASE OPERATIONS			
OFF	2.		
AMN	64.		
CIV	34.		
MEDICAL			
OFF	20.		
AMN	80.		
CIV	0.		
AVAILABLE PRODUCTIVE MAN-HOURS/MONTH			
HARDWARE MTC	122.		
ALL OTHERS	144.		
AVERAGE TRAINING DAYS/MONTH	21.0		
AVERAGE CLASSROOM TRAINING HRS/STUDENT/DAY	6.		
MISC. SUPPLY COST/MAN-YEAR ($)	112.		
PCS COST/MOVE ($)			
INST OFF	1913.	STD OFF	0. *
INST AMN	1118.	STD AMN	0. *
INST CIV	1913.	STD CIV	0. *
TDY EXPENSE			
AVG. ROUND TRIP TRANSP. COST ($)	85.		
DESTINATION PER DIEM			
OFF	11.		
AMN	4.		
CIV	21.		
DISCOUNT RATE (%)	10.00		

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GRADUATE SUMMARY

AVERAGE COURSE DURATION FOR GRADUATES = 30.0 HOURS

WASHOUT RATE = 15.0%

AVERAGE COURSE DURATION FOR WASHOUTS = 31.0 HOURS

STUDENT ENTRY INTERVAL = 30.0 HOURS

GRADUATE TYPE	NUMBER OF GRADUATES BY YEAR							
	1	2	3	4	5	SUBTOTAL	IN PROGRESS	TOTAL
ACTIVE DUTY FORCES								
OFFICERS	0.	0.	0.	0.	0.	0.	0.	0.
AIRMEN	340.	512.	684.	514.	344.	2394.	3.	2397.
CIVILIANS	0.	0.	0.	0.	0.	0.	0.	0.
GUARD AND RESERVE FORCES								
OFFICERS	0.	0.	0.	0.	0.	0.	0.	0.
AIRMEN	0.	0.	0.	0.	0.	0.	0.	0.
CIVILIANS	0.	0.	0.	0.	0.	0.	0.	0.
OTHER DOD (ARMY,NAVY)								
OFFICERS	0.	0.	0.	0.	0.	0.	0.	0.
AIRMEN	0.	0.	0.	0.	0.	0.	0.	0.
CIVILIANS	0.	0.	0.	0.	0.	0.	0.	0.
NON-DOD (MAP)	0.	0.	0.	0.	0.	0.	0.	0.
TOTAL GRADUATES	340.	512.	684.	514.	344.	2394.	3.	2397.
TOTAL ENTRANTS	403.	604.	806.	604.	403.	2820.		2820.
TOTAL WASHOUTS	60.	90.	121.	91.	61.	423.	0.	423.

NOTE: BECAUSE OF STUDENT PHASING, TOTAL WASHOUTS + TOTAL GRADUATES MAY NOT EQUAL TOTAL ENTRANTS IN ANY GIVEN YEAR.

MANPOWER SUMMARY (MAN-YEARS)

	YEAR 0	1	2	3	4	5	TOTAL
STUDENTS							
ACTIVE DUTY FORCE							
OFFICER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMEN	0.0	8.0	12.0	16.1	12.1	8.1	56.3
CIVILIAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUARD AND RESERVE							
OFFICER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CIVILIAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER DOD (ARMY,NAVY)							
OFFICER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMEN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CIVILIAN	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DOD (MAP)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL STUDENT LOAD	0.0	8.0	12.0	16.1	12.1	8.1	56.3
BASE PERMANENT PARTY							
INSTRUCTORS							
AIR FORCE	2.3	6.1	6.6	7.1	6.6	6.1	34.8
OTHER DOD (ARMY,NAVY)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CURRICULUM PERSONNEL	0.4	0.0	0.0	0.0	0.0	0.0	0.4
HARDWARE MAINTENANCE PERSONNEL	0.0	0.4	0.6	0.7	0.6	0.4	2.7
FACILITIES MAINTENANCE PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAINING ADMINISTRATIVE PERSONNEL	0.0	0.7	0.9	1.2	0.9	0.7	4.4
BASE OPERATING SUPPORT PERSONNEL	0.2	1.2	1.6	2.0	1.6	1.2	7.8
MEDICAL PERSONNEL	0.1	0.3	0.4	0.5	0.4	0.3	2.0
* TOTAL BASE PERMANENT PARTY	3.0	8.7	10.1	11.5	10.1	8.7	52.1
* TOTAL COURSE MAN-YEARS	3.0	16.7	22.1	27.6	22.2	16.8	108.4
ACTIVE DUTY FORCE PCS STUDENT LOAD	0.0	8.0	12.0	16.1	12.1	8.1	56.3
BASE PERMANENT PARTY - AF ONLY	3.0	8.7	10.1	11.5	10.1	8.7	52.1
* TOTAL PROGRAM 8 MAN-YEARS	3.0	16.7	22.1	27.6	22.2	16.8	108.4
ACTIVE DUTY FORCE TDY STUDENT LOAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GUARD AND RESERVE STUDENT LOAD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
* TOTAL AIR FORCE MAN-YEARS	3.0	16.7	22.1	27.6	22.2	16.8	108.4

COURSEWARE, HARDWARE, AND FACILITIES REQUIREMENTS BY YEAR

*** COURSEWARE ***

	NAME OF COPY	NAME OF MEASURE	MEASURES /COPY	INITIAL PREP. COST($)/ MEASURE	COPY COST($)/ MEASURE	ANNUAL REVISION RATE(%)	COPIES REQUIRED BY YEAR 1	2	3	4	5
PRINTED MEDIA											
PROGRAMMED TEXT	TEXT	PAGES	720.	7.25	0.008	20.0	410.	607.	809.	606.	404.
TECH ORDERS	SETS	PAGES	1300.	0.0	0.008	20.0	4.	5.	5.	5.	4.
STUDY REFERENCES	SETS	PAGES	95.	7.25	0.008	20.0	410.	607.	809.	606.	404.
LESSON PLANS	SETS	PAGES	20.	7.25	0.008	20.0	7.	3.	3.	2.	1.
DISPLAY MEDIA											
TRANSPARENCIES (GRP A)	SET	TRANSP	195.	7.45	0.050	20.0	1.	2.	2.	2.	1.
TRANSPARENCIES (GRP B)	SET	TRANSP	15.	7.45	0.050	20.0	2.	3.	3.	3.	2.
TRANSPARENCIES (GRP C)	SET	TRANSP	15.	7.45	0.050	20.0	1.	1.	1.	1.	1.
FILMSTRIP (GRP D)	FMST	FRAMES	105.	30.00	0.700	20.0	5.	7.	9.	7.	5.
FILMSTRIP (GRP E)	FMST	FRAMES	13.	30.00	0.700	20.0	5.	7.	8.	7.	5.
FILMSTRIP (GRP F)	FMST	FRAMES	13.	30.00	0.700	20.0	4.	5.	6.	5.	4.
FILMSTRIP (GRP G)	FMST	FRAMES	53.	30.00	0.700	20.0	6.	7.	8.	7.	6.
AUDIOTAPE (GRP H)	CASS	MIN	105.	8.00	0.100	20.0	5.	7.	9.	7.	5.
AUDIOTAPE (GRP I)	CASS	MIN	13.	8.00	0.100	20.0	5.	7.	8.	7.	5.
AUDIOTAPE (GRP J)	CASS	MIN	13.	8.00	0.100	20.0	4.	5.	6.	5.	4.
AUDIOTAPE (GRP K)	CASS	MIN	53.	8.00	0.100	20.0	6.	7.	8.	7.	6.
FILMSTRIP (GRP M)	FMST	FRAMES	59.	8.55	0.350	20.0	6.	9.	11.	9.	6.
FILMSTRIP (GRP N)	FMST	FRAMES	216.	8.55	0.350	20.0	8.	10.	12.	10.	8.
SOFTWARE											
NONE											

*** HARDWARE ***

	UNIT COST($)	REPAIR PART COST($)/ UNIT/YR.	STOCK FUND ITEM	ANNUAL LOSS RATE(%)	FAILURES /HOUR OF USAGE	TIME TO REPAIR/ FAILURE (HOURS)	UNITS REQUIRED BY YEAR 1	2	3	4	5
MEDIA HARDWARE											
OVERHEAD PROJECTOR	210.	21.	YES	7.0	0.01110	2.0000	2.	3.	3.	3.	2.
ASV TEACHING MACHINE	450.	45.	YES	10.0	0.00830	3.5000	6.	8.	9.	8.	6.
SV TEACHING MACHINE	1200.	120.	YES	10.0	0.00830	3.5000	6.	10.	12.	10.	8.
SPECIAL EQUIPMENT											
AN/URN-5 LF BEACON	11300.	1130.	NO	0.0	0.00700	7.5000	4.	5.	5.	5.	4.
TEST SET 1	528.	53.	YES	0.0	0.05000	3.0000	4.	5.	5.	5.	4.
TEST SET2	500.	50.	YES	0.0	0.05000	3.0000	4.	5.	5.	5.	4.
SIGNAL GENERATOR	368.	37.	YES	0.0	0.05000	3.5000	4.	5.	5.	5.	4.
OVERHEAD HARDWARE											
NONE											

*** FACILITIES ***

NAME	UNIT COST($)	SQUARE FEET/ FACILITY	MAINT. MAN-HOURS /SQ. FT. /MONTH	UNITS REQUIRED BY YEAR 1	2	3	4	5
CLASSROOM 1	0.	572.	0.0	2.	2.	2.	2.	2.
CLASSROOM 2	0.	572.	0.0	1.	2.	2.	2.	1.
CLASSROOM 3	0.	572.	0.0	1.	1.	1.	1.	1.
LAB	70000.	572.	0.0	1.	1.	1.	1.	1.

FUNCTIONAL COST SUMMARY (IN THOUSANDS OF DOLLARS)

	YEAR 0	1	2	3	4	5	TOTAL
COURSEWARE PROCUREMENT							
PRINTED MEDIA	0.0	13.0	9.7	12.5	9.7	6.9	51.8
DISPLAY MEDIA	0.0	15.1	3.1	3.2	2.6	2.5	26.5
SOFTWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HARDWARE PROCUREMENT							
MEDIA HARDWARE	14.5	5.2	4.5	-0.7	-1.1	-7.6	14.8
SPECIAL EQUIPMENT	51.2	12.8	0.0	0.0	-0.8	-3.4	59.8
OVERHEAD HARDWARE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FACILITY CONSTRUCTION	70.0	0.0	0.0	0.0	0.0	0.0	70.0
PAY AND ALLOWANCES							
STUDENTS	0.0	43.5	65.3	87.3	65.5	43.8	305.4
INSTRUCTORS	22.4	71.1	76.5	82.0	76.5	71.1	399.6
CURRICULUM PERSONNEL	4.0	0.0	0.0	0.0	0.0	0.0	4.0
HARDWARE MAINTENANCE PERSONNEL	0.0	3.8	5.7	6.7	5.7	3.8	25.7
FACILITIES MAINTENANCE PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAINING ADMINISTRATIVE PERSONNEL	0.0	8.0	10.2	13.6	10.2	8.0	50.0
BASE OPERATING SUPPORT PERSONNEL	1.9	11.7	15.6	19.5	15.6	11.7	76.0
MEDICAL PERSONNEL	1.1	3.2	4.2	5.3	4.2	3.2	21.2
PCS COSTS							
STUDENTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSTRUCTORS	4.5	7.2	3.4	4.5	3.4	3.4	26.4
TDY COSTS							
TRANSPORTATION	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DESTINATION PER DIEM	0.0	0.0	0.0	0.0	0.0	0.0	0.0
INSTRUCTOR TRAINING							
FACTORY TRAINING OF INITIAL INSTR. CADRE	14.0	0.0	0.0	0.0	0.0	0.0	14.0
EDUCATION TRAINING	4.4	1.1	2.2	3.3	1.1	1.1	12.1
MISCELLANEOUS OPERATING COSTS							
COMPUTER SERVICE CHARGES	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HARDWARE CONTRACT MAINTENANCE	0.0	0.0	0.0	0.0	0.0	0.0	0.0
HARDWARE REPLENISHMENT REPAIR PARTS	0.0	6.4	8.0	8.3	8.0	6.4	37.1
MISCELLANEOUS SUPPLIES	0.3	1.9	2.5	3.1	2.5	1.9	12.2
TOTAL COURSE COST	188.3	204.0	210.9	247.5	203.1	152.8	1206.6
DISCOUNTED COURSE COST (AT 10.00%)	188.3	185.5	174.3	186.0	138.7	94.9	967.6

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PROGRAM/APPROPRIATION COST SUMMARY (IN THOUSANDS OF DOLLARS)

	YEAR 0	1	2	3	4	5	TOTAL
AIR FORCE							
PROGRAM 8 - TRAINING, MEDICAL, OTHER PERSONNEL ACTIV.							
MILITARY CONSTRUCTION (3300)	70.0	0.0	0.0	0.0	0.0	0.0	70.0
OPERATIONS AND MAINTENANCE (3400)							
CIVILIAN PERSONNEL	2.6	43.5	47.6	52.3	47.6	43.5	237.1
TRAVEL OF PERSONNEL	0.0	1.9	0.0	0.0	0.0	0.0	1.9
PRINTING AND REPRODUCTION	0.0	28.1	12.8	15.7	12.3	9.4	78.3
OTHER PURCHASED SERVICES	18.4	1.1	2.2	2.2	1.1	1.1	26.1
OTHER SUPPLIES AND EQUIPMENT	20.4	14.9	15.0	10.7	8.5	-2.7	66.8
MILITARY PERSONNEL (3500)							
OFFICER PAY	3.4	2.5	3.3	4.1	3.3	2.5	16.1
AIRMAN PAY	26.3	95.2	126.6	157.9	126.8	95.5	628.3
PCS	4.5	3.4	3.4	4.5	3.4	3.4	22.6
TOTAL PROGRAM 8	142.6	190.6	210.9	247.4	203.0	152.7	1147.2
PROGRAM 5 - GUARD AND RESERVE FORCES							
OPERATIONS AND MAINTENANCE - ANG/AFR (3840/3740)							
CIVILIAN PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CIVILIAN PCS/TDY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NATIONAL GUARD/RESERVE PERSONNEL (3850/3700)							
OFFICER PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMAN PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ACTIVE DUTY GUARD/RESERVE PCS/TDY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER AIR FORCE PROGRAMS (1-4,6,7,9,10)							
AIRCRAFT, MISSILE, OTHER PROCURE. (3010,3020,3080)	45.6	11.4	0.0	0.0	0.0	0.0	57.0
OPERATIONS AND MAINTENANCE (3400)							
CIVILIAN PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAVEL OF PERSONNEL	0.0	1.9	0.0	0.0	0.0	0.0	1.9
MILITARY PERSONNEL (3500)							
OFFICER PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMAN PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL AIR FORCE	188.2	203.9	210.9	247.4	203.0	152.7	1206.1
OTHER DOD							
OPERATIONS AND MAINTENANCE							
CIVILIAN PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TRAVEL OF PERSONNEL	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MILITARY PERSONNEL							
OFFICER PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AIRMAN PAY	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PCS	0.0	0.0	0.0	0.0	0.0	0.0	0.0
NON-DOD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL COURSE COST	188.2	203.9	210.9	247.4	203.0	152.7	1206.1

NOTE: BECAUSE OF ROUNDING DIFFERENCES, TOTAL COURSE COSTS ON THE FUNCTIONAL AND THE PROG/APPROP. SUMMARIES MAY NOT BE IDENTICAL

V. ESTIMATING RELATIONSHIPS

This section presents the *general form* of the key estimating relationships used in MODCOM. Most of the equations require iteration for each applicable resource subtype as well as for each year. Readers interested in the specific details of aggregation, rounding, budget-appropriation mapping, and time-phasing should consult the program listing provided in Appendix C. Unless subscripted otherwise, all time-dependent variables used in the following equations are assumed to be for the same year.

A. MANPOWER

Student Graduates and Student Man-Years

MODCOM provides the option of calculating and time-phasing student graduates and man-years or directly entering them. The basic equations used in the calculation option are:

Student graduates = Student entrants * (1 − washout fraction)

Student washouts = Student entrants − student graduates

Student man-years = (Student graduates * graduate course duration in years) + (student washouts * washout course duration in years)

The algorithms employed to time-phase the graduates and man-years assume that the entrants for a given year arrive in equal-size groups, one group at the start of each entry interval.

PCS/TDY Students

Pipeline students (student types, 1, 3, and 5[1]) are always assumed to be in PCS status; lateral/upgrade and foreign students (student types 2, 4, 6, and 7) are assumed to be in PCS status only if the course duration is greater than or equal to 20 weeks. If the course duration is less than 20 weeks, lateral/upgrade and foreign students are assumed to be in TDY status.

Instructors

Year 0:

Instructor man-years = Initial instructor cadre * (months instructors are on board ÷ 12)

[1] Student types are listed on p. 39.

Years 1-5:

Instructor man-years = Direct input

Curriculum Personnel

Year 0:

Curriculum man-years = [Classroom instruction hours * curriculum man-hours per classroom instruction hour * (1 − fraction of courseware developed by instructors)] ÷ (available productive man-hours per month * 12)

Years 1-5:

Curriculum man-years = [.5 of classroom instruction hours * curriculum man-hours per classroom instruction hour * (1 − fraction of courseware developed by instructors) * annual courseware revision fraction] ÷ (available productive man-hours per month * 12)

The value .5 in the above equation represents the assumption that it takes half as long to revise courseware as it does to develop it originally.

Hardware-Maintenance Personnel

Year 0:

Hardware-maintenance man-years = 0

Years 1-5:

Hardware-maintenance man-years = (Average daily utilization rate in hours * average number of training days per month * number of failures per hour of use * average repair time per failure in hours * number of hardware units required) ÷ available productive man-hours per month

Facilities-Maintenance Personnel

Year 0:

Facilities-maintenance man-years = 0

Years 1-5:

Facilities-maintenance man-years = (Square feet per facility unit * maintenance man-hours per square foot per month * number of units of facility required) ÷ available productive man-hours per month

Training-Administrative Personnel

Year 0:

Training-administrative man-years = 0

Years 1-5:

Training-administrative man-years = Fixed training-administrative man-years per course + (variable training-administrative man-years per Type A man-year * Type A man-years)

where

Type A man-years = Student man-years + instructor man-years + curriculum man-years

Base Operating Support (BOS) Personnel

BOS man-years = Fixed BOS man-years per course + (variable BOS man-years per Type A man-year * Type A man-years) + (variable BOS man-years per Type B man-year * Type B man-years)

where

Type A man-years = PCS student man-years + instructor man-years + curriculum man-years + hardware-maintenance man-years + facilities-maintenance man-years + training-administrative man-years

and

Type B man-years = TDY student man-years

Medical Personnel

Medical man-years = Fixed medical man-years per course + (variable medical man-years per Type A

man-year * Type A man-years) + (variable medical man-years per Type B man-year * Type B man-years)

where

Type A man-years = Military PCS student man-years + military instructor man-years + military curriculum man-years + military hardware-maintenance man-years + military facility-maintenance man-years + military training-administrative man-years + military BOS man-years

and

Type B man-years = Military TDY student man-years

B. COSTS

Courseware Procurement

MODCOM distinguishes four types of courseware: (1) printed media for students and instructors; (2) printed media for instructors only; (3) display media; and (4) software. The only difference in determining procurement costs among the four types of courseware is in the calculation of procurement quantities. Therefore, the generalized cost calculations are presented first, followed by the more specific procurement quantity calculations.

Year 1:

Cost of courseware = (No. of courseware measures per copy * initial preparation cost per courseware measure) + (courseware procurement quantity * no. of courseware measures per copy * copy cost per courseware measure) + (courseware procurement quantity * packaging cost per copy) + (no. of courseware measures per copy * annual courseware revision fraction * initial preparation cost per courseware measure) + (no. of courseware measures per copy * annual courseware revision fraction * copy cost per courseware measure * no. of courseware copies required)

Years 2-5:

Cost of courseware = (Courseware procurement quantity * no. of courseware measures per copy * copy cost per courseware measure) +

(courseware procurement quantity * packaging cost per copy) + (no. of courseware measures per copy * annual revision fraction * initial preparation cost per courseware measure) + (no. of courseware measures per copy * annual revision fraction * copy cost per courseware measure * no. of courseware copies required)

Procurement Quantity of Class 1 Printed Media (for Students and Instructors)

Year 1:

No. of courseware copies required (if not direct input) = No. of student entrants + no. of instructor man-years + (no. of instructor man-years * instructor turnover fraction)

No. of courseware copies attrited = No. of courseware copies required * annual courseware replacement fraction

Courseware procurement quantity = No. of courseware copies required + no. of courseware copies attrited

Years 2-5:

Adjusted instructor-force change = Maximum of {[instructor man-years in year Z − instructor man-years in year (Z−1)] and 0}[2]

No. of courseware copies required (if not direct input) = No. of student entrants + adjusted instructor-force change + (no. of instructor man-years * instructor turnover fraction)

No. of courseware copies attrited = No. of courseware copies required * annual courseware replacement fraction

Courseware procurement quantity = No. of courseware copies required + no. of courseware copies attrited

[2] The function "maximum (*a*,0)" appears frequently throughout this section. It sets negative values equal to zero. Its analog "minimum (*a*,0)" sets positive values equal to zero.

Procurement Quantity of Class 2 Printed Media (for Instructors Only)

The only difference between the class 1 and class 2 procurement quantity calculations is in the determination of annual copy requirements.

Year 1:

No. of courseware copies required (if not direct input) = Number of instructor man-years + (no. of instructor man-years * instructor turnover fraction)

Years 2-5:

No. of courseware copies required (if not direct input) = Adjusted instructor-force change + (no. of instructor man-years * instructor turnover fraction)

Procurement Quantity of Display Media and Software

Year 1:

No. of courseware copies attrited = No. of courseware copies required * annual courseware replacement fraction

Courseware procurement quantity = No. of courseware copies required + number of courseware copies attrited

Years 2-5:

No. of courseware copies available at start of year Z = [No. of courseware copies available at start of year (Z−1)] + [courseware procurement quantity in year (Z−1)] − [no. of copies attrited in year (Z−1)]

No. of courseware copies attrited = No. of courseware copies required * annual courseware replacement fraction

Courseware procurement quantity = Maximum of [(no. of courseware copies required + no. of copies attrited − no. of copies available at start of year) and 0]

Hardware Procurement

All hardware procurement (including returns of surplus equipment) is done in the year preceding the one in which the changed operational requirement arises (i.e.,

initial procurement is made in year 0 and final inventory credits are taken in year 5).

The operational requirement in years 0 and 6 is initialized to zero; the following steps are then iterated over the interval Z = 1 to 6.

No. of hardware units attrited in year Z = No. of hardware units required in year Z * annual hardware attrition fraction

Hardware procurement quantity in year (Z−1) = No. of hardware units required in year Z + number of hardware units attrited in year Z − number of hardware units required in year (Z−1)

The procurement quantities calculated in the previous equation can be either positive or negative, the negative quantities representing hardware units in excess of requirements. The single matrix with positive and negative values is next split into two separate matrices—one of only positive values (debit matrix) and one of only negative values (credit matrix).

Hardware debit procurement quantity in year (Z−1) = Maximum of {[hardware procurement quantity in year (Z−1)] and 0}

Hardware credit procurement quantity in year (Z−1) = Minimum of {[hardware procurement quantity in year (Z−1)] and 0}

Finally, the costs are estimated.

Cost of hardware in year (Z−1) = [Hardware debit procurement quantity in year (Z−1) * hardware unit procurement cost per unit] + [hardware debit procurement quantity in year (Z−1) * miscellaneous repair part cost per unit per year * initial stock requirement in months ÷ 12] + [hardware credit procurement quantity in year (Z−1) * hardware unit procurement cost per unit * credit/residual value fraction]

Facility Construction

All facility construction is done in the year preceding the one in which the added operational requirement exists (i.e., all initial construction is done in year 0). Surplus facilities are assumed to be released for alternative uses with their estimated residual value treated as an offset to course cost.

The facility operational requirement in years 0 and 6 is initialized to zero and then the following steps are iterated over the interval Z = 1 to 6.

Facility procurement quantity in year (Z−1) = Facility units required in year Z − facility units required in year (Z−1)

The procurement quantities calculated in the previous equation can be either positive or negative, the negative quantities representing facility units in excess of requirements. The single matrix with positive and negative values is next split into two separate matrices—one of only positive values (debit matrix) and one of only negative values (credit matrix).

Facility debit procurement quantity in year (Z−1) = Maximum of {[facility procurement quantity in year (Z - 1)] and 0}

Facility credit procurement quantity in year (Z−1) = Minimum of {[facility procurement quantity in year (Z - 1)] and 0}

Finally, the costs are estimated.

Cost of facility construction in year (Z−1) = [Facility debit procurement quantity in year (Z−1) * construction cost per unit] + [facility credit procurement quantity in year (Z−1) * construction cost per unit * residual value fraction]

Pay and Allowances

Students and Instructors. Inasmuch as both students and instructors are identified by personnel designator (officer, airman, civilian–GS, civilian–WB, non-DoD) and pay grade, their pay and allowance cost may be calculated as follows:

Student (or instructor) pay and allowance cost = No. of student (or instructor) man-years for personnel designator/pay-grade combination * annual pay rate for personnel designator/pay-grade combination

Support Personnel. Pay and allowance costs for support personnel (curriculum, hardware maintenance, facilities maintenance, training administrative, base operations, and medical) are estimated as follows:

Support personnel Type Y pay and allowance cost = (No. of support personnel Type Y man-years * support personnel Type Y

officer fraction * average annual officer pay rate) + (no. of support personnel Type Y man-years * support personnel Type Y airman fraction * average annual airman pay rate) + (no. of support personnel Type Y man-years * support personnel Type Y civilian fraction * average annual civilian pay rate)

The civilian pay scale used (either General Schedule or Wage Board) is a function of the personnel type:

Curriculum Personnel	GS
Hardware-Maintenance Personnel	WB
Facilities-Maintenance Personnel	WB
Training-Administrative Personnel	GS
Base Operating Support Personnel	WB
Medical Personnel	GS

PCS Costs

Students.[3]

Student officer PCS moves = PCS officer entrants + PCS officer washouts + PCS officer graduates

Student airman PCS moves = PCS airman entrants + PCS airman washouts + PCS airman graduates

Student civilian PCS moves = PCS civilian entrants + PCS civilian washouts + PCS civilian graduates

Student PCS cost = (Student officer PCS moves * officer PCS cost per move) + (student airman PCS moves * airman PCS cost per move) + (student civilian PCS moves * civilian PCS cost per move)

Instructors.

Instructor-force change = Size of initial instructor cadre if Z = 0

= No. of instructor man-years in year Z − size of initial instructor cadre if Z = 1

= No. of instructor man-years in year Z − number of instructor man-years in year (Z−1) if Z > 1

[3] Foreign students are excluded from the PCS cost calculation.

Instructor turnover = 0 if Z = 0

= No. of instructor man-years in year Z * instructor turnover fraction if Z > 1

Instructor officer moves = Absolute value of officer instructor-force change + (2 * officer instructor turnover)

Instructor airman moves = Absolute value of airman instructor-force change + (2 * airman instructor turnover)

Instructor civilian moves = Absolute value of civilian instructor-force change + (2 * civilian instructor turnover)

The value 2 in the above equation accounts for the fact that each instructor being reassigned (one move out) must be replaced (one move in).

Instructor PCS costs = (Instructor officer moves * officer PCS cost per move) + (instructor airman moves * airman PCS cost per move) + (instructor civilian moves * civilian PCS cost per move)

TDY Costs[4]

Transportation.

Student TDY one-way trips = Student TDY entrants + student TDY washouts + student TDY graduates

TDY transportation cost = Student TDY one-way trips * average cost of TDY one-way transportation

Per Diem.

TDY per diem cost = (Student officer TDY man-years * 365 * officer TDY destination per diem) + (student airman TDY man-years * 365 * airman TDY destination per diem) + (student civilian TDY man-years * 365 * civilian destination per diem)

[4] Foreign students are excluded from the TDY cost calculations.

Instructor Training

Factory Training of Initial Instructor Cadre.

Factory training cost = Size of the initial instructor cadre * cost of initial instructor factory training per instructor

Education Training.

Instructor education requirement = [Maximum of (instructor-force change and 0)] + instructor turnover[a]

Education training cost = Instructor education requirement * cost of instructor education training per instructor

Miscellaneous Operating Costs

Computer Service Charges.

Computer service charges = Direct input

Hardware Contract Maintenance.

Hardware contract maintenance cost = No. of hardware units required * contract maintenance cost per unit per year

Hardware Replenishment Repair Parts.

Hardware replenishment repair parts cost = No. of hardware units required * miscellaneous repair part cost per unit per year

Miscellaneous Supplies.

Miscellaneous supply cost = Total course man-years * miscellaneous supply cost per man-year

Total course man-years are assumed to include all student (including foreign student), instructor, and support personnel man-years.

[a] See pp. 97, 98 for calculation of instructor-force change and instructor turnover.

Appendix A

OVERVIEW OF TECHNICAL TRAINING

A. BRIEF DESCRIPTION OF TECHNICAL TRAINING

Technical training provides officers and airmen with the skills they need to perform their assigned tasks; it is distinguished from basic military, flight, and professional training. Technical training may be conducted by: 1) a contractor either at the contractor's facility or at an Air Force base; 2) another government agency (Army, Navy, or other) at one of that agency's facilities; 3) an ATC field training detachment at an operational base; or 4) an ATC-operated technical training center (resident training). Resident training is the largest type, and accounts for over two-thirds of all technical training graduates.

Resident technical training is conducted at Chanute (Ill.), Keesler (Miss.), Lackland (Texas), Lowry (Colo.), and Sheppard (Texas) Air Force bases. These technical training centers have departments covering major subject areas:

Chanute	Aircraft maintenance Missile Weapon system support Weather Aircraft specialist
Keesler	Electronic principles Communications systems Communications and electronics officer Ground electronics Avionics Personnel and administration Computer systems
Lowry	Logistics Avionics Aerospace photography Aerospace munitions Intelligence
Sheppard	Aircraft maintenance Communication and missile Comptroller Civil engineering Transportation Field training
Lackland	Cryptography Security police Social actions Marksmanship Recruiting and instruction

There is some overlap in subject areas among the bases, but no duplication in anything but basic courses. Each department has several branches, and the branches are responsible for the training in a related group of courses. For example, the Avionics Department at Keesler contains the Radio Maintenance Branch, Navigation Systems Branch, Inertial Systems Branch, and Electronic Warfare Branch. A branch may have as few as three or as many as 30 courses. Each course has its own set of instructors and course supervisors.

Individual classes normally have only from six to ten students, primarily because an instructor can supervise only a limited number of students when they are working on complicated equipment. Students attend classes 6 hours a day with a 10-minute break every hour. Additionally, slow learners attend a 2-hour remedial program, a time which is used as a study or lab period by the other students.

B. ORGANIZATION OF TECHNICAL TRAINING CENTERS[1]

Table A-1 depicts the organization of a typical technical training *center;* Table A-2 provides a more detailed breakdown of the technical training *school.* The center itself is responsible for the administrative functions of the base, including maintaining military and civilian personnel records, developing and administering the annual operating budget, maintaining accounting and financial records, managing the allocation of resources to plans and missions, conducting the base safety program, conducting the community relations program, and providing chaplain and legal services. The functions performed by each of the other center organizations are described below.

Air Base Group

The air base group provides most of the support services of the base. Included are food services, commissary, housing services, laundry and dry cleaning, recreation services, and education services.

Civil Engineering Squadron. The civil engineering squadron is responsible for the maintenance and repair of real property, the construction of minor facilities, the provision of utilities, and for firefighting. It also performs custodial and sanitation functions.

Security Police. This squadron is responsible for installation entry and patrol and for investigating crime.

Maintenance and Supply Group

The maintenance and supply group supervises inventory and supply activities, maintains training equipment and aircraft, and procures all supply items used on the base.

Supply Squadron. The supply squadron receives all incoming shipments, provides storage for warehouse items, establishes and maintains inventory records, and manages the storage and transfer of fuels and oils.

[1] For a comprehensive discussion, see *Organization of Technical Training Centers,* ATC Regulation 23-40, Air Training Command, Randolph Air Force Base, Texas.

Table A-1

Organization of a Typical Technical Training Center

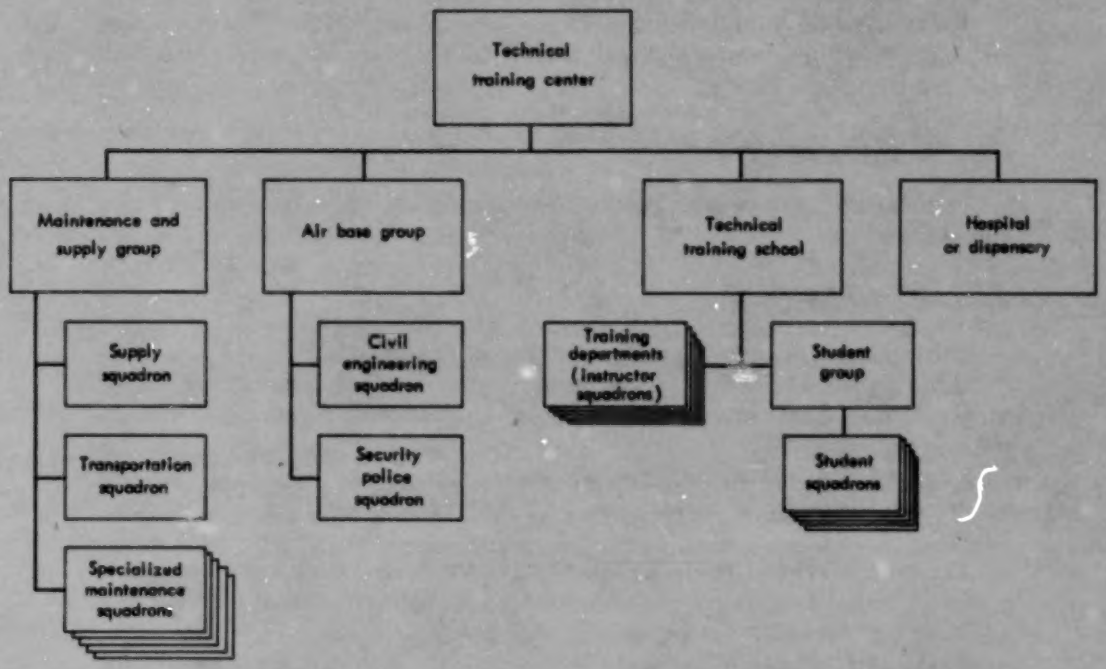
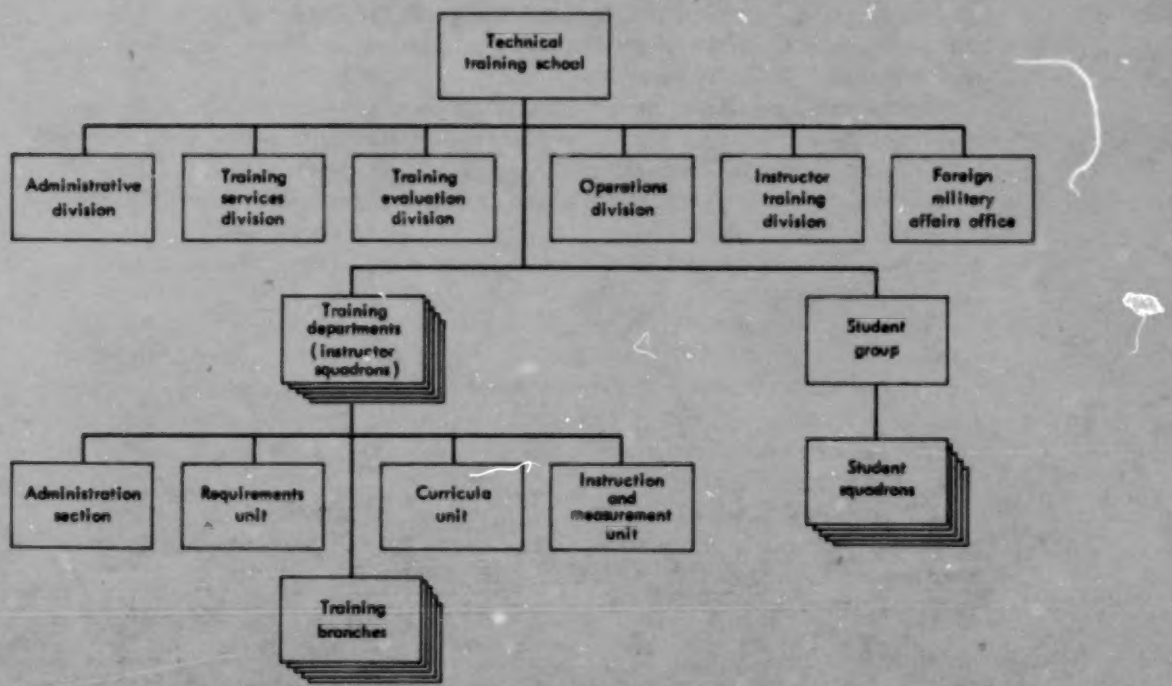


Table A-2

Organization of a Typical Technical Training School



Transportation Squadron. The transportation squadron provides for the transportation of personnel and freight, and operates and maintains the vehicles used for base transportation.

Specialized Maintenance Squadrons. Specialized maintenance squadrons are charged with inspecting and maintaining training aids, simulators, and both base and transient aircraft.

Hospital or Dispensary

The hospital, or dispensary, provides medical and dental care to military personnel.

Technical Training School

The technical training school is responsible for providing formal technical training at the technical training base and monitoring training conducted by other DoD components, civilian contractors, or by ATC at locations other than a technical training center.

Administrative Division. The administrative division coordinates administrative matters between departments and staff agencies and provides security services.

Training Services Division. This division designs and produces training aids and audio-visual aids, manages and operates TV production, and supervises the maintenance of training equipment.

Training Evaluation Division. The training evaluation division evaluates the effectiveness of technical training programs, examines the results of experimental tests, and submits recommendations for changes deemed necessary.

Operations Division. The operations division supervises the development of school plans for accomplishing training, the management of training resources (manpower, training equipment, facilities, and funds), the preparation and acquisition of course materials, and those training operations concerned with classroom instruction and the measurement of student progress.

Instructor Training Division. This division plans, supervises, administers, and conducts instructor preservice and inservice training programs.

Foreign Military Affairs Office. This office functions as the focal point for all actions required in support of the Military Assistance Training Program, including student administration and pay.

Student Group/Squadrons. The student group and squadrons are responsible for the morale, general welfare, discipline, and housing of students.

Training Department. A training department—for example, the Avionics Department at Keesler AFB—is responsible for training within a subject area and typically consists of an administrative section, a requirements unit, a curricula unit, an instruction and measurement unit, and several training branches.

The *administrative section* maintains administrative records and files of correspondence and publications.

The *requirements unit* develops departmental requirements for manpower, training equipment, facilities, and funds, and provides staff surveillance over manning documents, organizational charts, student-entry changes, flow charts, classroom utilization, and visual aids and training equipment.

The *curricula unit* determines the training curricula required for resident and nonresident training missions; prepares curricula for resident courses, career development courses, and extension courses; and maintains curricula in a current status.

The *instruction and measurement unit* controls and evaluates the testing program of the department and reviews training to insure that the quality of instruction and of instructor training is high.

A *training branch* is responsible for the training in a related group of courses. The Avionics Department at Keesler, for example, contains the Radio Maintenance Branch, Navigation Systems Branch, Inertial Systems Branch, and Electronic Warfare Branch.

Appendix B

CHARACTERISTICS OF TYPICAL CLASSROOM MEDIA HARDWARE

This appendix contains characteristics of the typical kinds of classroom media hardware referenced in Table 7 of Section III. It is based on a sampling of hardware contained in *The Audio-Visual Equipment Directory*. The objective was to classify media hardware in a way that would be useful to course planners who may not be media experts.

A. AUDIO MOTION VISUAL

Sound Motion Picture Projectors

Individual Viewer

Cost: $175 to $500; average: $335
Screen width: 6 to 16 inches
Sound amplifier power: less than 10 watts
Sound method: primarily magnetic; sometimes optical
Program time: 6 to 30 minutes, depending on type of cartridge used
Threading system: continuous-loop cartridge
Film: Super 8
Weight: up to 45 pounds; portable
Audience size: 1 to 3 people

Classroom Projector

Cost: $145 to $1000; average: $510
Screen width: 3 to 4 feet
Sound amplifier power: less than 10 watts
Sound method: magnetic
Program time: open-reel projectors: 40 minutes; cartridge-type projectors: 30 minutes or less
Threading system: equally likely to be self-threaded or cartridge-loaded
Film: Super 8
Weight: less than 27 pounds; portable
Audience size: 30 people

Large Classroom or Small Auditorium Projector

Cost: $710 to $1350; average: $990
Screen width: 4 to 8 feet

Sound amplifier power: 10 to 20 watts
Sound method: primarily optical; sometimes magnetic
Program time: at least 55 minutes
Threading system: manual
Film: 16 mm
Weight: 28 to 45 pounds; portable
Audience size: 150 people

Auditorium Projector

Cost: $670 to $3995; average: $2160
Screen width: 8 feet and over
Sound amplifier power: over 20 watts
Sound method: optical; alternative method: magnetic
Program time: at least 55 minutes
Threading system: equally likely to be manual or self-threaded
Film: 16 mm
Weight: over 45 pounds; stationary
Audience size: over 150 people

Variable Speed Viewer

These systems present motion pictures where motion is needed and stop on single frames when motion is not required. Meanwhile, a separate sound cassette continues running and, with nonaudible pulses on a second track, controls the visual presentation. Because still-frame (or long-frame-period) motion pictures are common, large savings in film footage are possible (a manufacturer estimates a savings of 25 percent).

Cost: $280 to $495; average: $410
Film: Super 8 in continuous-loop cartridge or in special reel-to-reel cassette
Screen size: 4 by 6 to 6 by 8 inches (built-in); one model can also front-project a 40 by 40-inch image
Sound source: cassette
Program time: 45 minutes
Weight: 14 to 25 pounds; portable
Audience size: 1 to 3 people; 30 people for model with front-projection capability

Videotape Recorders and Players

Monochrome (1/2 inch)

Cost: $595 to $2250; average: $1220
Tape size: 1/2 inch
Program time: 60 minutes
Threading: primarily reel-to-reel; alternative method: cassette
Recording capability: all models

Resolution: 300 lines (center)
Weight: 29 to 58 pounds; portable

Monochrome (1 inch)

Cost: $1650 to $5950; average: $3465
Tape size: 1 inch
Program time: 60 minutes
Threading: reel-to-reel
Recording capability: most models
Resolution: 300 to 400 lines (center)
Weight: 73 to 78 pounds; portable

Color (1/2 or 3/4 inch)

Cost: $875 to $1745; average: $1310
Tape size: 1/2 or 3/4 inch
Program time: 30 to 60 minutes
Threading: primarily cassette; alternative method: reel-to-reel
Recording capability: most models
Resolution: 240 lines (center)
Weight: 31 to 64 pounds; portable

Color (1 inch)

Cost: $2150 to $8000; average: $5340
Tape size: 1 inch
Program time: 60 minutes
Threading: primarily reel-to-reel; alternative method: cassette
Recording capability: all models
Resolution: 300 to 400 lines (center)
Weight: 45 to 110 pounds; portable

Video Projectors

Monochrome, Low Cost

Cost: $3000 to $7900; average: $4350
Inputs: closed-circuit television (CCTV), videotape recorder, and "off-the-air" broadcast
Resolution: 300 to 600 lines
Picture Size: can produce 12-foot-wide picture in a dark auditorium
Weight: 322 to 900 pounds; stationary
Audience size: 150 people

Monochrome, High Cost

Cost: $11,000 to $30,000; average: $20,500
Inputs: CCTV, videotape recorder, and "off-the-air" broadcast

Resolution: 600 lines
Picture size: can produce 12-foot-wide picture in a dark auditorium
Weight: 450 to 460 pounds; stationary

Color

Cost: $16,500 to $43,000; average: $32,510
Inputs: CCTV, videotape recorder, and "off-the-air" broadcast
Resolution: 320 to 600 lines
Picture size: can produce 12-foot-wide picture in a dark auditorium
Weight: 322 to 900 pounds; stationary

Video Monitors/Receivers

Monochrome, Individual Monitor

Cost: $165 to $335; average: $245
Screen size: 4 to 11 inches
Inputs: primarily CCTV
Sound output: generally 3-inch round speakers, side-mounted
Weight: 9 to 20 pounds
Audience size: 1 to 3 people

Monochrome, Group Receiver and/or Monitor

Cost: $130 to $445; average: $250
Screen size: 12 to 17 inches
Inputs: most models CCTV and UHF/VHF
Sound output: generally 3-by-5-inch oval speakers, side-mounted
Weight: 9 to 20 pounds
Audience size: 1 to 3 people

Monochrome, Group Receiver and/or Monitor

Cost: $130 to $445; average: $250
Screen size: 12 to 17 inches
Inputs: most models CCTV and UHF/VHF
Sound output: generally 3-by-5-inch oval speakers, side- or front-mounted
Weight: 16 to 41 pounds; portable
Audience size: 10 people

Monochrome, Classroom Receiver and/or Monitor

Cost: $195 to $630; average: $350
Screen size: 22 to 23 inches
Inputs: generally CCTV and UHF/VHF
Sound output: 4-to-6-inch round speakers, front-mounted

Weight: 16 to 95 pounds; generally stationary
Audience size: 30 people

Color, Group Receiver and/or Monitor

Cost: $550 to $745; average: $615
Screen size: 12 to 19 inches
Inputs: CCTV and UHF/VHF
Sound output: 3-to-4-inch round speakers, front-mounted
Weight: 42 to 70 pounds; generally portable
Audience size: 10 people

Color, Classroom Receiver and/or Monitor

Cost: $480 to $850; average: $640
Screen size: 25 inches
Inputs: CCTV and UHF/VHF
Sound output: 4-by-6 to 5-by-7-inch oval speakers, front-mounted
Weight: 120 to 133 pounds; stationary
Audience size: 30 people

B. AUDIO STILL VISUAL

Sound Filmstrip Projectors/Viewers

Individual Viewer

Cost: $100 to $365; average: $235
Screen size: 3 by 4 to 9 by 12 inches (built-in)
Projects: 35-mm filmstrip
Sound source: primarily cassette; alternative methods include audio disc and continuous-loop cartridge
Sound output: 2-inch round to 4-by-6-inch oval speakers
Operation: primarily automatic (nonaudible pulse superimposed on audio track); some manual
Weight: 6 to 30 pounds; portable
Audience size: 1 to 3 people

Group Projector

Cost: $125 to $490; average: $285
Screen size: 9 by 12 to 11 by 15 inches (built-in or contained in cover)
Projects: 35-mm filmstrip
Sound source: primarily cassette; alternative methods include audio disc and continuous-loop cartridge
Sound output: 2-inch round to 4-by-6-inch oval speakers
Operation: equally likely to be manual or automatic

Weight: 7 to 32 pounds; portable
Audience size: 10 people

Classroom Projector

Cost: $315 to $500; average: $385
Projects: 35-mm filmstrip
Sound source: primarily cassette; sometimes audio disc
Sound output: 3-by-6 to 6-by-9-inch oval speakers
Operation: manual or automatic with remote control
Weight: 18 to 25 pounds; portable
Audience size: 30 people

Sound Slide Projectors/Viewers (2 by 2 inch)

Individual and Group Projector

Cost: $280 to $795; average: $445
Screen size: equally likely to require front projection screen or to have built-in rear projection screen (ranging in size from 9 by 9 to 12 by 18 inches)
Sound source: primarily cassette; sometimes sound-on-slide clip
Sound output: 3-inch round to 6-by-9-inch oval speakers
Operation: primarily automatic with remote control; some manual
Weight: 12 to 35 pounds; portable
Audience size: 1 to 10 people

Classroom Projector

Cost: $330 to $995; average: $505
Screen size: equally likely to require front projection screen or to have built-in rear projection screen (ranging in size from 10 by 10 to 18 by 18 inches)
Sound source: primarily cassette; sometimes sound-on-slide clip
Sound output: 6-inch round to 4-by-10-inch oval speakers
Operation: automatic with remote control
Weight: 11 to 45 pounds; portable
Audience size: 30 people

Individual Audio Still Visual Teaching Machines

"Teaching machines present information via some audio, visual, or audio/visual unit which is integral to, or controlled by, the device. Generally, teaching machines employ a 'multiple choice' type of test. The user is required to indicate, by pressing a response button, a single-choice correct answer from a field of four or five possible answers. However, only a limited number of teaching machines employ branching type programs. In most cases pressing a 'wrong answer' button

only results in a 'try again' direction to the learner."[1] Most teaching machines allow only *learner control of the rate of presentation*, what is often referred to as "self-paced instruction."

Learner Control of Rate of Presentation

Cost: $235 to $995; average: $450
Type of response: primarily multiple choice; alternative method is constructed response. Responses usually recorded on separate answer sheets, workbooks, or data processing cards, but some machines allow for recording multiple choice responses on the program itself
Type of program: linear (response-paced)
Method of operation: either the machine or the learner stops the presentation until the learner responds or otherwise signals the machine to proceed
Visual display: primarily built-in rear projection screen ranging in size from 4 by 5 to 9 by 7 inches; some with front projection
Picture source: primarily filmstrip; sometimes 35-mm slide or integrated audio visual combination cartridge
Sound source: primarily audiotape cassette; sometimes audio disc or integrated audio visual combination cartridge
Weight: 5 to 33 pounds; generally portable
Audience size: one person

Learner Control of Content of Presentation

Cost: $1950
Type of response: multiple choice
Type of program: branching (adaptive)
Method of operation: learner is supplied with branching directions for each answer that may be selected and advances the program to the point indicated
Visual display: built-in rear projection screen 4 by 6 inches in size
Picture source: 35-mm microfilm
Sound source: encoded audiotape cassette presented in a separate unit
Weight: visual unit 15 pounds, audio unit 30 pounds
Audience size: one person

Machine Control of Rate of Presentation

Cost: $295 to $795; average: $510
Type of response: multiple choice. Response usually temporarily recorded on program itself; alternative methods are recording errors on a counter or on a separate answer tape

[1] Brian G. Boucher et al., *Handbook and Catalog for Instructional Media Selection*, Educational Technology Publications, Englewood Cliffs, New Jersey, 1974, p. 43.

Type of program: linear (response-paced)
Method of operation: program advances automatically upon receipt of correct answer
Visual display: primarily built-in rear projection screen about 4 by 8 inches; some with front projection
Picture source: various—filmslide, filmstrip, or integrated audio still visual cartridge
Sound source: various—audio disc, audio tape cassette, or integrated audio still visual cartridge
Weight: 8 to 38 pounds; generally portable
Audience size: one person

C. MOTION VISUAL

Silent Motion Picture Projectors

Individual Viewer

Cost: $175
Screen: 4 by 6 inches (built-in)
Program time: 4 minutes
Threading system: continuous-loop cartridge
Film: Super 8
Weight: 18 pounds; portable
Audience size: 1 to 3 people

Classroom Projector

Cost: $145 to $255; average: $190
Program time: 6 to 14 minutes
Threading system: continuous-loop cartridge
Film: Super 8
Weight: 10 to 15 pounds; portable
Audience size: 30 people

D. STILL VISUAL

Silent Filmstrip Projectors/Viewers

Individual Viewer, Low Cost

Cost: $25 to $90; average: $50
Screen size: 3 by 4 to 6 by 9 inches (built-in)
Projects: 35-mm filmstrip
Operation: manual
Weight: 3 to 15 pounds; portable
Audience size: 1 to 3 people

Individual Viewer, High Cost

Cost: $225 to $400; average: $310
Screen size: 5 by 6-1/2 to 14 by 14 inches (built-in)
Projects: 35-mm filmstrip
Operation: manual
Weight: 10 to 16 pounds; portable
Audience size: 1 to 3 people

Group Projector

Cost: $40 to $145; average: $65
Projects: 35-mm filmstrip; some also have 2-by-2-inch slide capability
Operation: manual
Weight: 4 to 9 pounds; portable
Audience size: 10 people

Classroom Projector

Cost: $65 to $265; average: $135
Projects: 35-mm filmstrip; most also have 2-by-2-inch slide capability
Operation: manual; a few have remote control
Weight: 4 to 24 pounds; portable
Audience size: 30 people

Silent Slide Projectors/Viewers (2 by 2 inch)

Individual Viewer

Cost: $85 to $110; average: $100
Screen size: built-in rear projection screen ranging in size from 7 by 7 to 8 by 8 inches
Capacity: 24 to 30 slides
Operation: manual
Weight: 7 to 20 pounds; portable
Audience size: 1 to 3 people

Classroom Projector

Cost: $40 to $880; average: $320
Screen size: some of models have built-in rear projection screens ranging in size from 14 by 14 to 16 by 25 inches; others require front projection screens
Capacity: 80 to 140 slides
Operation: primarily remote control, some manual only
Weight: 3 to 20 pounds; portable
Audience size: 30 people

Large Classroom or Small Auditorium

Cost: $530 to $1530; average: $795
Capacity: 2, 80, or 140 slides
Operation: primarily remote control; a few manual only
Weight: 16 to 41 pounds; portable
Audience size: 150 people

Auditorium Projector

Cost: $3500 to $3975; average: $3740
Capacity: 2 slides
Operation: manual
Weight: 300 to 500 pounds; fixed
Audience size: over 150 people

Random-Access Slide Projectors

A random-access projector is a slide projector in which a slide may be directly accessed by the user by identifying its storage location.

Classroom Projector

Cost: $500 to $1915; average: $1070
Capacity: 80 slides
Search interval: 2 to 4 seconds
Weight: 15 to 63 pounds; portable
Audience size: 30 people

Auditorium Projector

Cost: $1515 to $5950; average: $3215
Capacity: 50 to 500 slides
Search interval: 2.5 to 4 seconds
Weight: 28 to 180 pounds; portable and fixed
Audience size: 150 people and more

Overhead Projectors

Classroom

Cost: $150 to $395; average: $210
Aperture size: 10 by 10 inches
Lamp power: 600 watts
Lens focal length: usually 14 inches
Weight: 16 to 36 pounds; portable
Audience size: 30 people

Large Classroom or Small Auditorium

Cost: $255 to $900; average: $580
Aperture size: 10 by 10 inches
Lamp power: 600 to 1200 watts
Lens focal length: 8.5 to 16 inches; one sample model has adjustable focal length of up to 40 inches (for use at rear of room)
Weight: 17 to 54 pounds; portable
Audience size: 150 people

Auditorium

Cost: $1800 to $3500; average: $2325
Aperture size: 10 by 10 up to 14 by 14 inches (for x-rays)
Lamp power: 1000 to 2000 watts
Lens focal length: 18 to 70 inches
Weight: in the 100-pound range; fixed
Audience size: over 150 people

Individual Still Visual Teaching Machines

Learner Control of Rate of Presentation

Cost: $140 to $375; average: $270
Type of response: generally constructed; alternative method is multiple choice. Responses recorded on separate answer sheet, punched card, workbook, or tape, or temporarily recorded on program itself
Type of program: linear (response-paced)
Method of operation: either the machine or the learner stops the presentation until the learner responds or otherwise signals the machine to proceed
Visual display: primarily built-in rear projection screen ranging in size from 2 by 3 to 8-1/2 by 11 inches; alternate method is front projection
Picture source: primarily filmstrip cartridge; sometimes filmstrip
Weight: 9-1/2 to 21 pounds; generally portable
Audience size: one person

Learner Control of Content of Presentation

Cost: $220 to $825; average: $565
Type of response: multiple choice. Response recorded in memory or errors recorded on counter
Type of program: branching (adaptive)
Method of operation: learner is supplied with branching directions for each answer selected and advances the program to the point indicated

Visual display: built-in rear projection screen size 4 by 6 inches, magnifying viewer, or front projection
Picture source: encoded 35-mm microfilm or 35-mm slides
Weight: 13 to 15 pounds; plus 10 pounds if front projection used
Audience size: one person

Machine Control of Rate of Presentation

Cost: $225 to $375; average: $300
Type of response: multiple choice. Errors recorded on counter
Type of program: linear (response-paced)
Method of operation: program advances automatically upon receipt of correct answer
Visual display: built-in rear projection screen about 7 by 10 inches
Picture source: filmstrips or slides
Weight: 5 to 25 pounds; portable
Audience size: one person

Machine Control of Content of Presentation

Cost: $1200
Type of response: multiple choice. Temporarily recorded on program
Type of program: branching (adaptive)
Method of operation: learner automatically provided with immediate feedback as to correctness of response and then sent to material appropriate to the response
Visual display: built-in rear projection screen 7 by 9 inches
Picture source: 35-mm filmstrip cassettes
Weight: 36 pounds
Audience size: one person

Microform Readers

Microform readers use built-in projection screens to magnify a reduced image back to its original size. The reduction ratio is at least 12 to 1 and usually 20 to 1 or greater. Micro*film* is generally a 16- or 35-mm filmstrip. Micro*fiche* is a film card usually 4 by 6 inches in size.

Microfilm Readers

Cost: $370 to $770; average: $615
Operation: generally manual
Magnification: 24X
Screen size: 14 by 14 inches
Weight: 40 to 50 pounds; generally fixed
Notes: 2/3 of models are also fiche readers
Audience size: one person

Microfiche Readers

Cost: $80 to $600; average: $235
Operation: manual
Magnification: 24X
Screen size: 8-1/2 by 11 to 14 by 14 inches
Weight: 3 to 80 pounds; mostly lightweight, portable
Audience size: one person

E. AUDIO

Audio Disc Players (Monaural)

Cost: $55 to $325; average: $115
Maximum record size: generally 12 inches; a few will handle 16-inch discs
Compatibility: most stereo-compatible (that is, will not damage stereo discs)
Speeds: practically all have four speeds (16, 33-1/3, 45, and 78 rpm)
Headsets: most have headset provisions
Sound output: 4-by-6-inch oval to 12-inch round speakers
Sound amplifier power: generally 4 to 40 watts
Weight: 8 to 41 pounds; portable
Audience size: 1 to 30 people

Audio Tape Recorders and Players (Monaural)

Reel-to-Reel, Classroom

Cost: $165 to $280; average: $215
Maximum reel size: 7 inches
Recording capability: all sample models
Sound amplifier power: 8 to 25 watts
Speeds: 3-3/4 and 7-1/2 inches per second
Response: 50 to 20,000 Hz
Sound output: 3-by-6 to 4-by-10-inch oval speakers
Weight: 12 to 25 pounds; portable
Audience size: 30 people

Cassette, Individual, and Group

Cost: $30 to $85; average: $70
Speed: 1-7/8 inches per second
Recording capability: about half sample models
Sound amplifier power: 1/4 to 1-1/2 watts
Response: 200 to 4000 Hz to 50 to 10,000 Hz range
Headset provisions: nearly all sample models

Sound output: 2-1/2-to-4-inch round speakers
Weight: 2 to 11 pounds; portable
Audience size: 1 to 10 people

Cassette, Classroom

Cost: $140 to $290; average: $200
Speed: 1-7/8 inches per second
Recording capability: nearly all sample models
Sound amplifier power: 8 to 25 watts
Response: 50 to 10,000 Hz range
Sound output: 4-by-8 to 6-by-9-inch oval speakers
Weight: 12 to 18 pounds
Audience size: 30 people

Individual Audio Teaching Machine with Learner Control of Rate of Presentation

Cost: $186 to $470; average: $328
Response: constructed; no provisions for recording response
Program: linear (response-paced)
Method of operation: machine stops until learner restarts the presentation
Sound output: audiotape cassette
Weight: 6 pounds; portable
Audience size: one person

F. OTHER

Study Carrel

Cost: $95 to $330; average: $160
Construction: all models are single-position carrels with side panels, bookshelf, and AC power outlet
Dimensions: in 36-by-24-inch range
Height of working surface: 29 inches

Terminals for Student Response

Terminals for student response are connected to computers. They contain both the means by which the student enters his answers in the computer (input device) and the means by which the computer communicates with the student (display). Input devices typically are keyboards, either teletype or typewriter-like. Sometimes a light pen, a touch-sensitive surface, or an electronic tablet is used, either alone or in conjunction with a keyboard. The display is usually printed, one character at a time as by a teletype machine, on paper (called "hard copy") or on the face of a cathode ray tube (CRT). If a terminal uses a light pen, touch-sensitive surface, or electronic tablet for input, it must use either a CRT or TV receiver for display.

Hard Copy Display

Cost: purchase range: $985 to $4995; average: $3400
Lease (annual) range: $600 to $2760; average: $1800
Maintenance (annual) range:[8] $300 to $540; average: $432
Line length: generally 132 characters; alternative is 80 characters
Type-out speed: generally 30 characters per second; alternatives are 10 and 120 characters per second
Weight: generally not portable, but a few are in the 25 to 45 pound class

Cathode Ray Tube Display

Cost: purchase range: $720 to $9000; average: $3640
Lease (annual) range: $588 to $3720; average: $1680
Maintenance (annual) range:[9] $120 to $480; average: $312
Visual display: screen size 8 by 4 to 7 by 10 inches; average is 8.75 by 5.7 inches
Line length: generally 80 characters
Number of lines: generally 24
Type-out speed: generally 1200 characters per second
Weight: usually stationary

Group Response Monitor

These receive, display, and summarize student responses to multiple choice questions entered through individual response units. Three or four choices may be provided. Responses are monitored on meters showing the number of students choosing a given answer, the number of correct answers, and other summary data. The more expensive of the two monitors described below also allows for instructor control of projection equipment.

Cost: $720 (plus $17.50 per individual response unit) for the less expensive unit; $3656 (which includes the cost of 20 individual response units) for the more expensive unit
Weight: less expensive unit: 6 pounds, portable; more expensive unit: 200 pounds, stationary
Audience size: less expensive unit: 100; more expensive unit: "any number"

[8] Maintenance usually included in lease, if leased.
[9] Maintenance usually included in lease, if leased.

Appendix C

THE MODCOM FORTRAN PROGRAM

This appendix contains a listing of the MODCOM FORTRAN Program, and several diagrams designed to help the reader to follow the program logic.

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- HDWRE..... 260
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INITI..... 267
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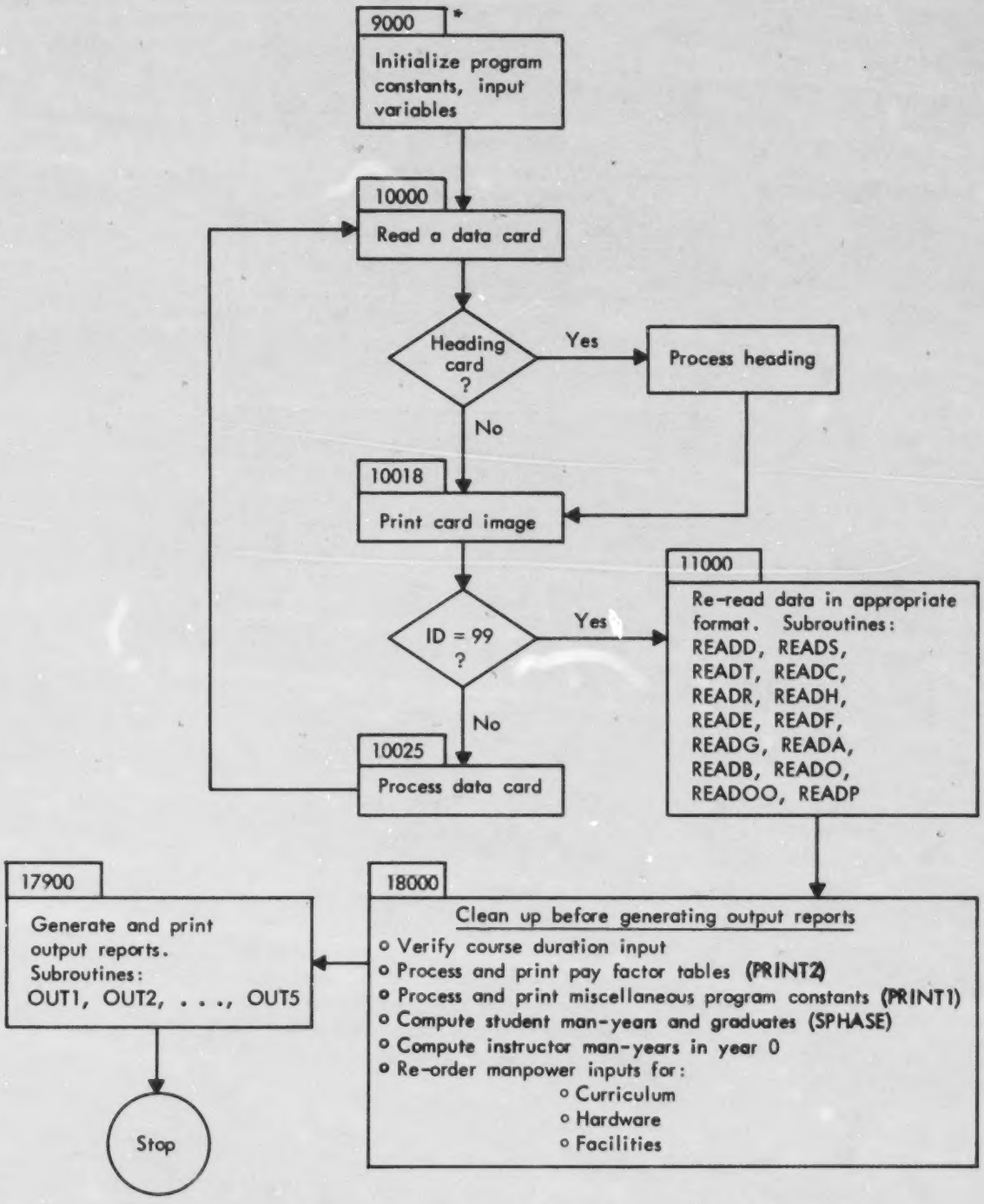
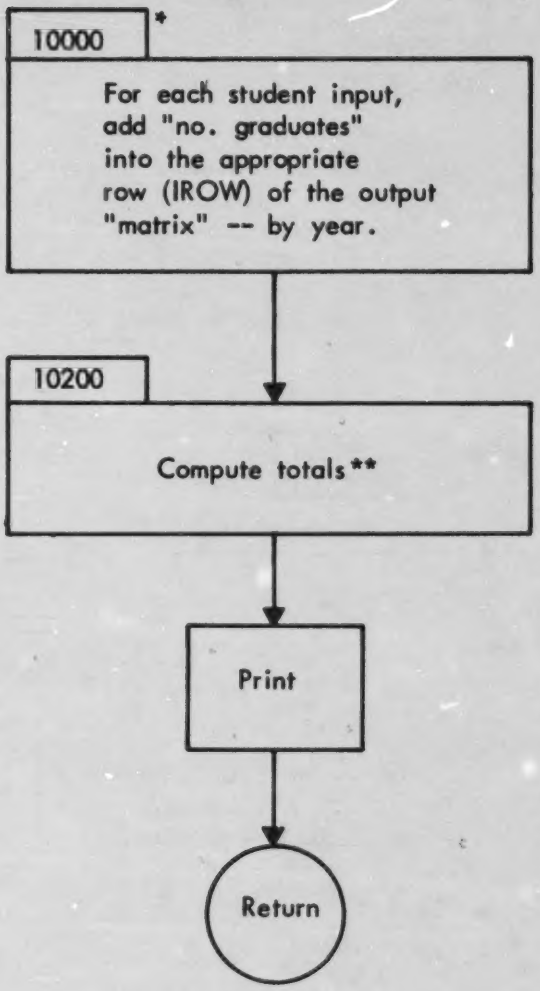
MAIN PROGRAM ☆



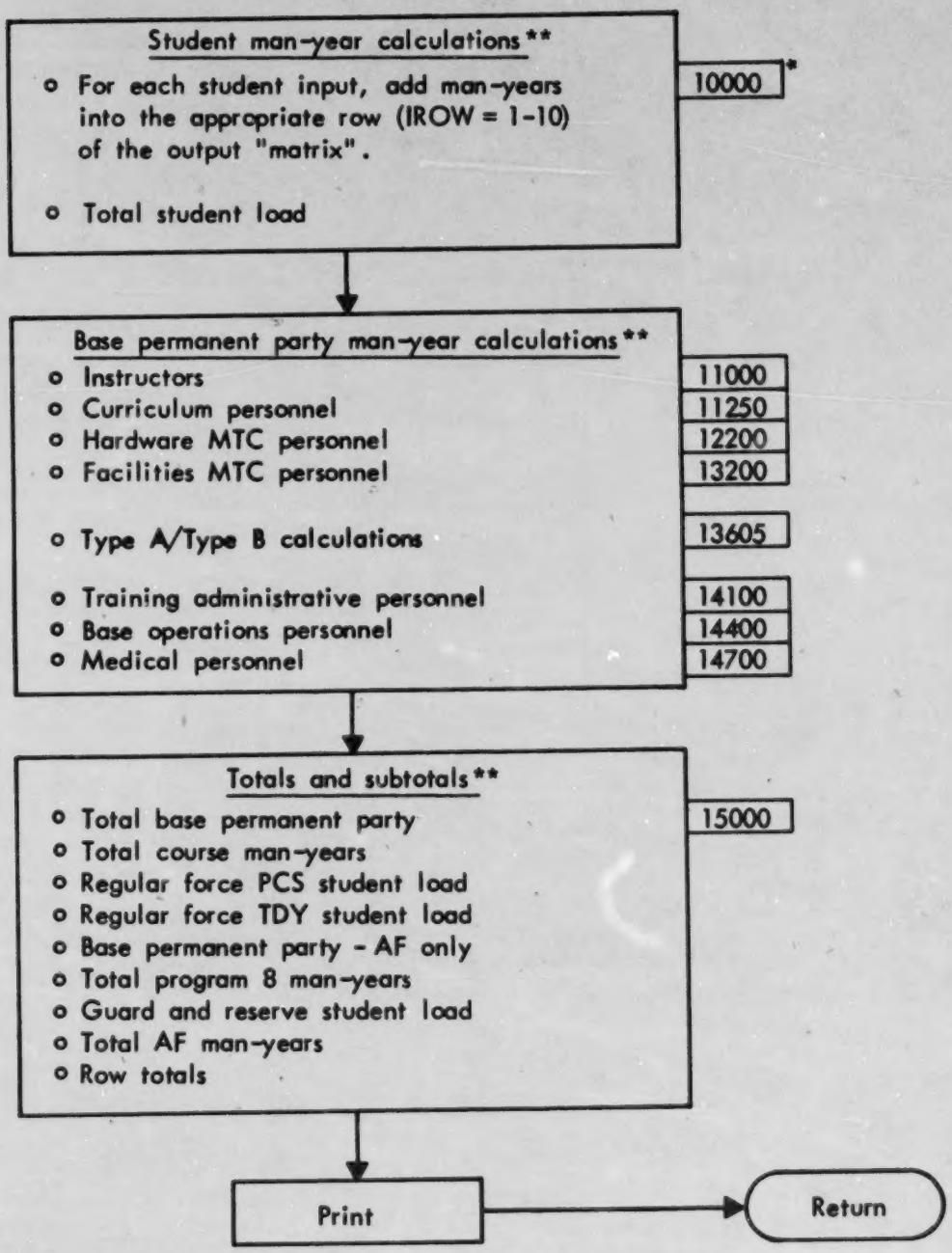
* Numbers in tabs are FORTRAN statement numbers
☆ See index for subroutine page numbers

SUBROUTINE OUT1☆
Graduate Summary


10000*
For each student input, add "no. graduates" into the appropriate row (IROW) of the output "matrix" -- by year.
10200
Compute totals**
Print
Return

* Numbers in tabs are FORTRAN statement numbers
** Values are rounded to an integer prior to totaling
☆ See index for subroutine page numbers

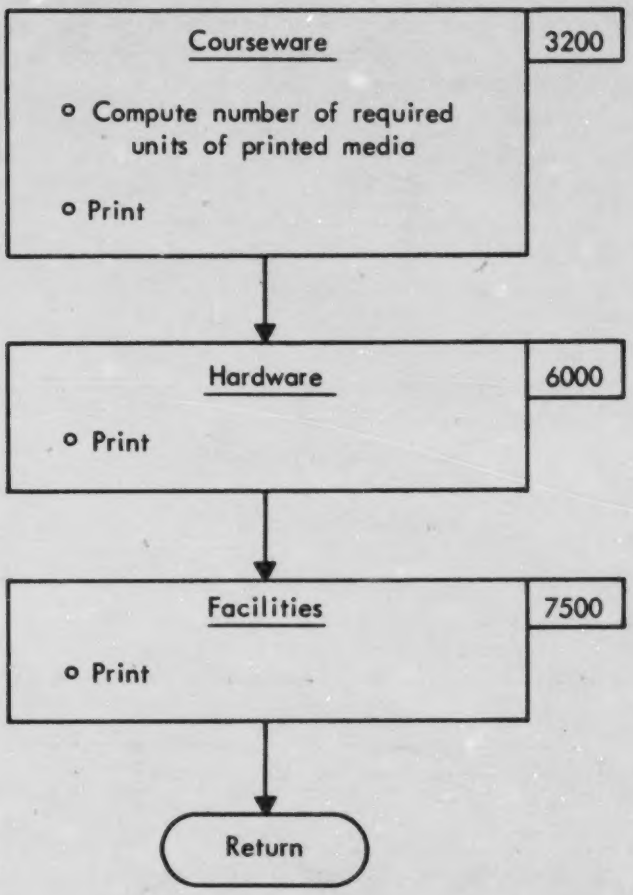
SUBROUTINE OUT2 ☆
Manpower Summary



* Numbers in tabs are FORTRAN statement numbers
** Values are rounded to 1 decimal place prior to totaling
☆ See index for subroutine page numbers

SUBROUTINE OUT3 ☆

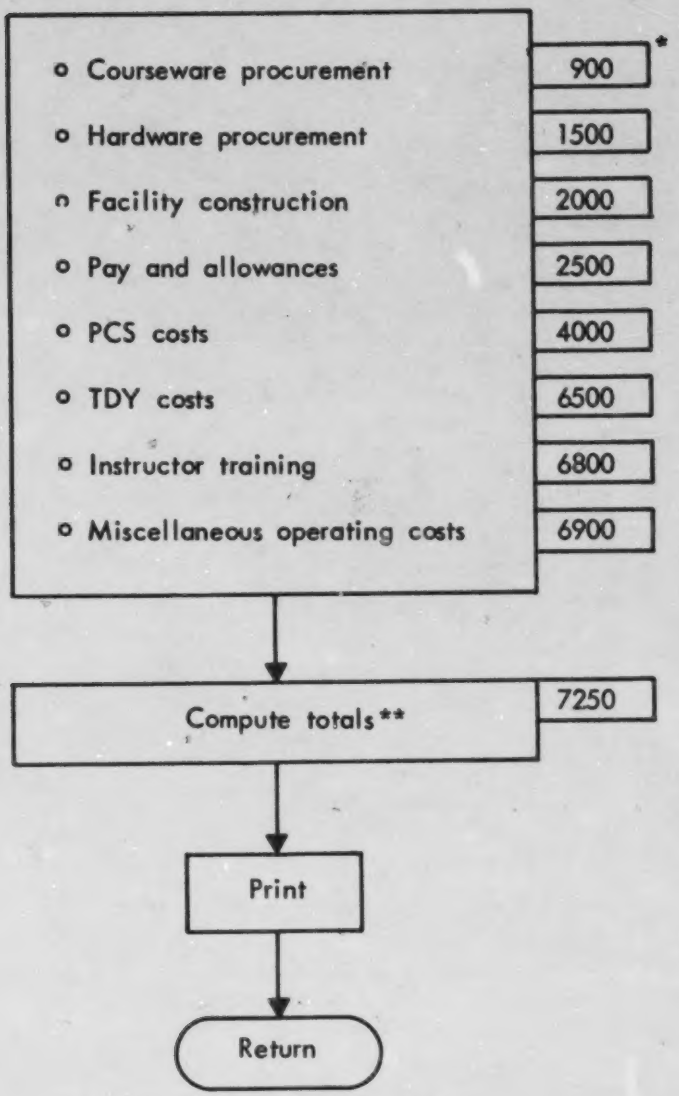
Courseware, Hardware, and Facilities Requirements



* Numbers in tabs are FORTRAN statement numbers

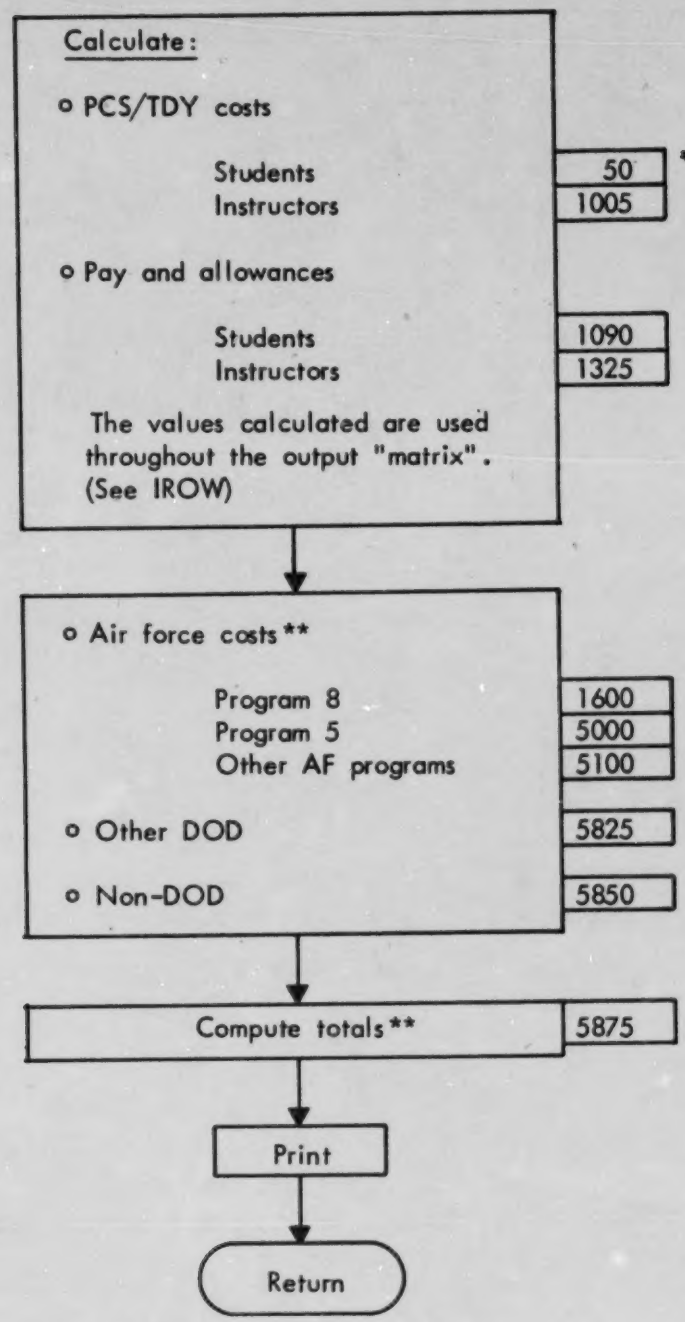
☆ See index for subroutine page numbers

SUBROUTINE OUT4☆
Functional Cost Summary



* Numbers in tabs are FORTRAN statement numbers
** Prior to totaling, values are converted to thousands of dollars, then rounded to 1 decimal place
☆ See index for subroutine page numbers

SUBROUTINE OUT5☆
Program/Appropriation Cost Summary



* Numbers in tabs are FORTRAN statement numbers
** Prior to totaling, values are converted to thousands of dollars, then rounded to 1 decimal place
☆ See index for subroutine page numbers

SUBROUTINE ROLES

BLOCK DATA	Initializes "Labeled Common" variables
ERROR	Prints Error Messages
HDWRE	Calculates Hardware Debit/Credit
HEAD	Prints centered heading at top of each page
INITA	Blanks an array
INITF	Zeroes a floating array
INITI	Zeroes an integer array
OUT1	Calculates and prints the "Graduate Summary" Report
OUT2	Calculates and prints the "Manpower Summary" Report
OUT3	Calculates and prints the "Courseware, Hardware, and Facilities Requirements" Report
OUT4	Calculates and prints the "Functional Cost Summary" Report
OUT5	Calculates and prints the "Program/Appropriation Cost Summary" Report
PAYGR	Looks up Pay Factors from tables
PCSIN	Computes PCS Instructor Moves and Education Requirements
PCSST	Computes PCS Student Moves
PRINT1	Prints Program Constants and Overrides
PRINT2	Prints Pay Factor Tables and Overrides
READA	Reads Input Format 11: Training Administrative, Base Operating Support, and Medical Manpower Inputs
READB	Reads Input Format 12: Computer Service Charges
READC	Reads Input Format 5: , Courseware Procurement Inputs
READD	Reads Input Format 2: Course Duration Inputs
READE	Reads Input Format 8: Hardware Maintenance Manpower Inputs
READF	Reads Input Format 9: Facility Procurement Inputs

SUBROUTINE ROLES

READG	Reads Input Format 10: Facility Maintenance Manpower Inputs
READH	Reads Input Format 7: Hardware Procurement Inputs
READO	Reads Input Format 13: Officer/Airman/Civilian Distribution Overrides
READOO	Reads Input Format 14: Miscellaneous Overrides
READP	Reads Input Format 15: Pay and Allowance Overrides
READR	Reads Input Format 6: Curriculum Manpower Inputs
READS	Reads Input Format 3: Student Inputs
READT	Reads Input Format 4: Instructor Inputs
ROUND0	Rounds a quantity to an integer
ROUND1	Rounds a quantity to one decimal place
SPHASE	Calculates time phased graduates and man-years
TDYST	Computes TDY Student Moves and Man-years
TITLE1	Prints title for "Input Data" listing
TITLE2	Prints title for "Error Messages" listing

SUBROUTINES: WHICH PROGRAMS CALL THEM

Subroutine Name	Called by
ERROR	MAIN READA READB READC READD READE READF READG READH READO READOO READP READR READS READT
HDWRE	OUT4 OUT5
HEAD	OUT1 OUT2 OUT3 OUT4 OUT5 PRINT1 PRINT2 TITLE1 TITLE2
INITA	MAIN HEAD
INITF	MAIN HDWRE OUT1 OUT2 OUT3 OUT4 OUT5 PCSIN PCSST SPHASE TDYST
INITI	MAIN
OUT1	MAIN
OUT2	MAIN
OUT3	MAIN
OUT4	MAIN
OUT5	MAIN
PAYGR	OUT4 OUT5
PCSIN	OUT4 OUT5
PCSST	OUT4 OUT5
PRINT1	MAIN
PRINT2	MAIN
READA	MAIN
READB	MAIN
READC	MAIN
READD	MAIN
READE	MAIN
READF	MAIN
READG	MAIN

SUBROUTINES: WHICH PROGRAMS CALL THEM

Subroutine Name	Called by				
READH	MAIN				
READO	MAIN				
READOO	MAIN				
READP	MAIN				
READR	MAIN				
READS	MAIN				
READT	MAIN				
ROUND0	HDWRE READC	OUT1 READF	OUT3 READH	OUT4 SPHASE	OUT5
ROUND1	OUT2	OUT4	OUT5		
SPHASE	MAIN				
TDYST	OUT4	OUT5			
TITLE1	MAIN				
TITLE2	ERROR				

COMMON BLOCKS

/A/	Training Administrative, Base Operating Support, and Medical Manpower inputs (see READA)
/ALL/	"Universal" variables
/B/	Computer Service Charge inputs (see READB)
/C/	Courseware Procurement inputs (see READC)
/D/	Course Duration inputs (see READD)
/E/	Hardware Maintenance Manpower inputs (see READE)
/F/	Facility Procurement inputs (see READF)
/G/	Facility Maintenance Manpower inputs (see READG)
/H/	Hardware Procurement inputs (see READH)
/O/	Officer/Airman/Civilian Distribution Overrides; Miscellaneous Overrides (see READO, READOO) *Note: This common block is EQUIVALENCED to OVRRID array
/O1/	OFLAG array. Contains an * in each position for which an /O/ override value was input.
/P/	Pay and Allowance Overrides (see READP)
/PAY/	Pay and Allowance Tables. Values are set in the MAIN program and are overridden by entries, if any, in the /P/ arrays.
/Q/	Internal constants: Officer/Airman/Civilian Distributions and Miscellaneous Constants. Values are set in the BLOCK DATA subroutine, and will be overridden by any corresponding non-blank value in /O/. *Note: This common block is EQUIVALENCED to QCONST array
/R/	Curriculum Manpower inputs (see READR)
/S/	Student inputs (see READS)
/T/	Instructor inputs (see READT, READD)

SUBROUTINES USING EACH COMMON BLOCK

/A/	MAIN	READA	OUT2				
/ALL/	MAIN	READD	READS	READT	READC	READR	READH
	READE	READF	READG	READA	READB	READP	READO
	READOO	OUT1	OUT2	OUT3	OUT4	OUT5	SPHASE
	TITLE1	TITLE2	HEAD	ERROR			
/B/	MAIN	READB	OUT4				
/C/	MAIN	READC	OUT2	OUT3	OUT4		
/D/	MAIN	READD	OUT1	OUT2	OUT4	OUT5	PCSST
	SPHASE	TDYST					
/E/	MAIN	READE	OUT2	OUT3			
/F/	MAIN	READF	OUT2	OUT3	OUT4		
/G/	MAIN	READG	OUT2	OUT3			
/H/	MAIN	READH	OUT2	OUT3	OUT4	OUT5	HDWRE
/O/	MAIN	READO	READOO				
/O1/	MAIN	READO	READOO				
/P/	MAIN	READP					
/PAY/	MAIN	OUT4	OUT5	PAYGR			
/Q/	MAIN	OUT2	OUT4	OUT5	SPHASE		
/R/	MAIN	READR	OUT2	OUT3			
/S/	MAIN	READS	OUT1	OUT2	OUT4	OUT5	PCSST
	SPHASE	TDYST					
/T/	MAIN	READD	READT	OUT2	OUT3	OUT4	OUT5
	PCSIN						
/V1/	OUT1	OUT3					
/V2/	OUT2	OUT4	OUT5				
/V4/	OUT4	OUT5					

ERROR MESSAGES

ILLEGAL INPUT FORMAT ON CARD #N1. CARD EXCLUDED FROM MODEL.
LEGAL RANGE = 01-15.

MORE THAN 1 COURSE DURATION CARD ENCOUNTERED. CARD #N1 WAS USED.
CARD #N2 EXCLUDED FROM MODEL.

NO LEGAL COURSE DURATION CARD WAS FOUND. JOB TERMINATED.

STUDENT ENTRY INTERVAL EQUALS ZERO. JOB TERMINATED.

GRADUATE COURSE DURATION EXCEEDS TWO YEARS. PROGRAM TERMINATED.

WASHOUT COURSE DURATION EXCEEDS ONE YEAR. PROGRAM TERMINATED.

THE MAXIMUM NO. OF FORMAT TYPE M1 INPUTS WAS EXCEEDED. CARD #N1
EXCLUDED FROM MODEL.

ILLEGAL STUDENT PERSONNEL DESIGNATOR. LEGAL RANGE = 01-05. CARD
#N1 EXCLUDED FROM MODEL.

ILLEGAL STUDENT TYPE. LEGAL RANGE = 01-07. CARD #N1 EXCLUDED FROM
MODEL.

ILLEGAL PERSONNEL DESIGNATOR - PAY GRADE PAIR ON STUDENT INPUT.
CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE STUDENT TYPE - PERSONNEL DESIGNATOR - PAY GRADE. CARD #N1
WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR INPUT METHOD ON STUDENT INPUT.
LEGAL VALUES = 00,01. CARD #N1 EXCLUDED FROM MODEL.

INCONSISTENT STUDENT TYPE - PERSONNEL DESIGNATOR ON STUDENT INPUT.
CARD #N1 EXCLUDED FROM MODEL.

ILLEGAL INSTRUCTOR PERSONNEL DESIGNATOR. LEGAL RANGE = 01-04.
CARD #N1 EXCLUDED FROM MODEL.

ILLEGAL PERSONNEL DESIGNATOR - PAY GRADE PAIR ON INSTRUCTOR INPUT.
CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE PERSONNEL DESIGNATOR - PAY GRADE ON INSTRUCTOR INPUT.
CARD #N1 WAS USED. CARD # N2 EXCLUDED FROM MODEL.

ILLEGAL INSTRUCTOR TYPE. LEGAL VALUES = 08,09. CARD #N1 EXCLUDED
FROM MODEL.

****

*NOTE: N1,N2 REFER TO CARD NUMBERS LISTED IN LEFTMOST COLUMN
OF "INPUT DATA" PRINTOUT (PAGE 1 OF OUTPUT).
M1 REFERS TO INPUT FORMAT TYPE (1-15).

ERROR MESSAGES

COURSEWARE ID MISSING OR INVALID ON COURSEWARE PROCUREMENT INPUT. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE COURSEWARE ID ON COURSEWARE PROCUREMENT INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL COURSEWARE CLASS ON COURSEWARE PROCUREMENT INPUT. LEGAL VALUES = 01-04. CARD #N1 EXCLUDED FROM MODEL.

COURSEWARE ID MISSING OR INVALID ON CURRICULUM MANPOWER INPUT. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE COURSEWARE ID ON CURRICULUM MANPOWER INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR INPUT METHOD ON CURRICULUM MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #N1 EXCLUDED FROM MODEL.

EQUIPMENT ID MISSING OR INVALID ON HARDWARE PROCUREMENT INPUT. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE HARDWARE ID ON HARDWARE PROCUREMENT INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL HARDWARE CLASS ON HARDWARE PROCUREMENT INPUT. LEGAL VALUES = 01-03. CARD #N1 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR CREDIT OPTION ON HARDWARE PROCUREMENT INPUT. LEGAL VALUES = 0 OR 1. CARD #N1 EXCLUDED FROM MODEL.

HARDWARE ID MISSING OR INVALID ON HARDWARE MTC MANPOWER INPUT. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE HARDWARE ID ON HARDWARE MTC MANPOWER INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR INPUT METHOD ON HARDWARE MTC MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #N1 EXCLUDED FROM MODEL.

FACILITY ID MISSING OR INVALID ON FACILITY PROCUREMENT INPUT. CARD #N1 EXCLUDED FROM MODEL..

DUPLICATE FACILITY ID ON FACILITY PROCUREMENT INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

FACILITY ID MISSING OR INVALID ON FACILITY MTC MANPOWER INPUT. CARD #N1 EXCLUDED FROM MODEL.

****

*NOTE: N1,N2 REFER TO CARD NUMBERS LISTED IN LEFTMOST COLUMN OF "INPUT DATA" PRINTOUT (PAGE 1 OF OUTPUT).
M1 REFERS TO INPUT FORMAT TYPE (1-15).

ERROR MESSAGES

DUPLICATE FACILITY ID ON FACILITY MTC MANPOWER INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR INPUT METHOD ON FACILITY MTC MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #N1 EXCLUDED FROM MODEL.

INVALID PERSONNEL TYPE ON ADMIN.,BASE OP., AND MEDICAL PERSONNEL INPUT. LEGAL VALUES = 13-15. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE PERSONNEL TYPE ON ADMIN.,BASE OP., AND MEDICAL PERSONNEL INPUT. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL VALUE FOR INPUT METHOD ON ADMIN.,BASE OP., AND MEDICAL PERSONNEL INPUT. LEGAL VALUES = 01,02. CARD #N1 EXCLUDED FROM MODEL.

MORE THAN 1 COMPUTER SERVICE CHARGES CARD ENCOUNTERED. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ONE OR MORE OF THE % OFF-AIR-CIV DISTRIBUTIONS DOES NOT TOTAL 100% ON CARD #N1. TABLE VALUES WERE USED.

MORE THAN 1 OFF/AIR/CIV OVERRIDES CARD ENCOUNTERED. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

MORE THAN 1 MISCELLANEOUS OVERRIDES CARD ENCOUNTERED. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

ILLEGAL PERSONNEL DESIGNATOR ON PAY FACTOR OVERRIDE INPUTS. LEGAL RANGE = 01-05. CARD #N1 EXCLUDED FROM MODEL.

ILLEGAL PERSONNEL DESIGNATOR - PAY GRADE PAIR ON PAY FACTOR OVERRIDE INPUTS. CARD #N1 EXCLUDED FROM MODEL.

DUPLICATE PERSONNEL DESIGNATOR - PAY GRADE ON PAY FACTOR OVERRIDE INPUTS. CARD #N1 WAS USED. CARD #N2 EXCLUDED FROM MODEL.

****

*NOTE: N1,N2 REFER TO CARD NUMBERS LISTED IN LEFTMOST COLUMN OF "INPUT DATA" PRINTOUT (PAGE 1 OF OUTPUT).
M1 REFERS TO INPUT FORMAT TYPE (1-15).

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
A (=11)	-	Integer	/ALL/	#	Input Format "A": Training Admin., Base Op., Medical Manpower Inputs
AFMPC(I)	3	Real	/A/	Man-yrs.	Fixed man-years per course for training admin., base oper. support, medical functions
AIM(I)	3	Integer	/A/	#	Input method for training admin., base oper. support, medical functions: 01=calculation 02=thruput
ALOSS(K)	6	Real	-	#	Number of hardware units attrited during year "K"
AMN(I)	9	Real	-	$	Pay Factor Table; airmen
AMNAV	-	Real	-	$	Average Pay Factor; airmen
AMOVAM(K)	6	Real	-	Moves	Instructor airman moves in year "K" (K=0,...,5)
AMOVCV(K)	6	Real	-	Moves	Instructor civilian moves in year "K" (K=0,...,5)
AMOVOF(K)	6	Real	-	Moves	Instructor officer moves in year "K" (K=0,...,5)
ANP(K,I)	6x3	Real	/A/	Man-yrs.	Number of training admin., base oper. support; medical man-years in year "K"

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
APT(I)	3	Integer	/A/	#	Personnel type: APT(1)=13: Training Administrative APT(2)=14: Base Operating Support APT(3)=15: Medical
AV(K)	6	Real	-	#	Number of hardware units available at start of year "K"
AVMPCS(I)	3	Real	/A/	Man-yrs.	Variable man-years per Type A man-year for training admin., base oper. support, medical functions
AVMTDY(I)	3	Real	/A/	Man-yrs.	Variable man-years per Type B man-year for training admin., base oper. support, medical functions
B (=12)	-	Integer	/ALL/	#	Input Format "B": Computer Service Charge Inputs
BSC(K)	5	Real	/B/	$	Computer service charges in year "K"
C (=5)	-	Integer	/ALL/	#	Input Format "C": Courseware Procurement Inputs
CARD(I)	39	Alpha	-	-	Card image (cols 3-80) of the most recently read data card
CARP(I)	75	Real	/C/	%	Annual replacement rate

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
CARV(I)	75	Real	/C/	%	Annual revision rate
CC(I)	75	Integer	/C/	#	Courseware Class 1=Printed media students+instructors 2=Printed media instructors only 3=Display media 4=Software
CCCM(I)	75	Real	/C/	$	Copy cost per courseware measure
CCOPY(K,I)	2x75	Alpha	/C/	-	Name of courseware copies (e.g., books, reels, sets)
CGS(I)	18	Real	-	$	Pay Factor Table; civilians-GS
CGSAV	-	Real	-	$	Average Pay Factor; civilians-GS
CID(I)	75	Integer	/C/	#	Input Format 5 Courseware ID#
CIPCM(I)	75	Real	/C/	$	Initial preparation cost per courseware measure
CMEAS(K,I)	3x75	Alpha	/C/	-	Name of courseware measure (e.g., pages, slides)
CNMU(I)	75	Real	/C/	Measure/ Copy	Total number of courseware measure per copy

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
CNURQ(K,I)	5x75	Real	/C/	Copies	Number of copies of courseware required in year "K"(integer value) (Note: If inputs for years 1-5 all = 0, values will be calculated internally)
COMPLT(K)	7	Real	-	Entrants	Number of entrants who will successfully complete course in year "K"
CPCC(I)	75	Real	/C/	$	Packaging cost per copy
CREDIT(K)	6	Real	-	#	Hardware credit procurement quantity in year "K"
CREDT(L)	2	Alpha	-	-	Hardware credit option. Values="YES" or "NO"
CRV(I)	75	Real	/H/	%	Credit Residual % of hardware
CTYPE(K,I)	11x75	Alpha	/C/	-	Name of courseware
CWB(I)	14	Real	-	$	Pay Factor Table; civilians-WB
CWBAV	-	Real	-	$	Average Pay Factor; civilians-WB
D (=2)	-	Integer	/ALL/	#	Input Format "D": Course Duration and Instructor Training Factors
DEBIT(K)	6	Real	-	#	Hardware debit procurement quantity in year "K"
DEI	-	Real	/D/	Hrs.	Student Entry Interval

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
DGCD	-	Real	/D/	Hrs.	Average course duration per graduate
DR	-	Real	/D/	%	Discount Rate
DWCD	-	Real	/D/	Hrs.	Average course duration per washout
DWR	-	Real	/D/	%	Washout rate
E (=8)	-	Integer	/ALL/	#	Input Format "E": Hardware Maintenance Manpower Inputs
EAVRT(I)	75	Real	/E/	Hrs.	(see footnote)
EAVRTX(J)	75	Real	/E/	Hrs.	Average time to repair per hardware failure
EDREQ(K)	6	Real	-	#	Number of instructors to be given educ. training in year "K" (K=0,...,5)
EDUR(K,I)	5x75	Real	/E/	Hrs.	(see footnote)
EDURX(K,J)	5x75	Real	/E/	Hrs.	Average hardware daily utilization rate in year "K"
EFRPH(I)	75	Real	/E/	#/Hr.	(see footnote)
EFRPHX(J)	75	Real	/E/	#/Hr.	Number of hardware failures per hour of use

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footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

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VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
EID(I)	75	Integer	/E/	#	(see footnote)
EIDX(J)	75	Integer	/E/	#	Input Format 8 Hardware ID#
EIM(I)	75	Integer	/E/	#	(see footnote)
EIMX(J)	75	Integer	/E/	#	Input method for hardware manpower inputs: 01=calculation 02=thruput
ENP(K,I)	5x75	Real	/E/	Man-yrs.	(see footnote)
ENPX(K,J)	5x75	Real	/E/	Man-yrs.	Number of hardware maintenance man-years in year "K"
F (=9)	-	Integer	/ALL/	#	Input Format "F": Facility Procurement Inputs
FAIL(K)	7	Real	-	Washouts	Number of entrants who will wash out in year "K"
FC(K)	6	Real	-	#	Instructor force change in year "K" (K=0,...,5)
FCCPU(I)	25	Real	/F/	$	Construction cost per facility unit
FID(I)	25	Integer	/F/	#	Input Format 9 Facility ID#

footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
FNURQ(K,I)	5x25	Real	/F/	#	Number of units of facility required in year "K" (integer value)
FOR(I)	20	Real	-	$	Pay Factor Table; foreign
FORAV	-	Real	-	$	Average Pay Factor; foreign
FRATE(K)	7	Real	-	Washouts/yr	Failure rate in year "K"
FTYPE(K,I)	15x25	Alpha	/F/	-	Name of facility type
G (=10)	-	Integer	/ALL/	#	Input Format "G": Facility Maintenance Manpower Inputs
GID(I)	25	Integer	/G/	#	(see footnote)
GIDX(J)	25	Integer	/G/	#	Input Format 10 Facility ID#
GIM(I)	25	Integer	/G/	#	(see footnote)
GIMX(J)	25	Integer	/G/	#	Input method for facility manpower inputs: 01=calculation 02=thruput

footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
GMPSF(I)	25	Real	/G/	Man-hrs./ Sq.Ft./Mo.	(see footnote)
GMPSFX(J)	25	Real	/G/	Man-hrs./ Sq.Ft./Mo.	Facility maintenance man-hours per square foot per month
GNP(K,I)	5x25	Real	/G/	Man-yrs.	(see footnote)
GNPX(K,J)	5x25	Real	/G/	Man-yrs.	Number of facilities maintenance man-years in year "K"
GRADS(I,J)	7x7	Real	-	Graduates	Number of year "I" entrants graduating in year "J"
GRATE(K)	7	Real	-	Grads/yr.	Graduate rate in year "K"
GSFPF(I)	25	Real	/G/	Sq.Ft.	(see footnote)
GSFPFX(J)	25	Real	/G/	Sq.Ft.	Square feet per facility unit
H (=7)	-	Integer	/ALL/	#	Input Format "H": Hardware Procurement Inputs
HAAF(I)	75	Real	/H/	%	Hardware annual attrition rate

footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
HC(I)	75	Integer	/H/	#	Hardware class 1=media 2=special equipment 3=overhead
HCMTC(I)	75	Real	/H/	$	Annual Hardware Maintenance Cost
HID(I)	75	Integer	/H/	#	Input Format 7 Hardware ID#.
HISR(I)	75	Real	/H/	Months	Initial hardware stock requirement
HNURQ(K,I)	5x75	Real	/H/	#	Number of units of hardware required in year "K" (integer value)
HPCU(I)	75	Real	/H/	$	Hardware procurement cost per unit
HRCUY(I)	75	Real	/H/	$	Miscellaneous repair part cost per hardware unit per year
HTYPE(K,I)	15x75	Alpha	/H/	-	Name of hardware type

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VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
ICDTYP(I)	400	Integer	-	#	Input Format Nos. for all the legal data cards that were read
IFLAG	-	Integer	/ALL/	-	0: Course duration < 20 weeks 1: Course duration >= 20 weeks
IPAGE	-	Integer	/ALL/	#	Page number, printed at top of each page of output.
IROW	-	Integer	-	-	See V1,V2,V4,V5
ITYPE	-	Integer	-	#	Input Format # on the most recently read data card
LPP	-	Integer	/ALL/	#	Number of lines per page of output. Used for determining when to print heading at top of new page.
NCARDS	-	Integer	-	#	Counts the total number of data cards, with a legal Input Format #, that were read. (Usually = NTOTCD)
NITYPE(I)	20	Integer	/ALL/	#	The number of type "I" cards that were read (where I = U,D,S,T,C,R,H, E,F,G,A,B,0,00,P).
NLINES	-	Integer	/ALL/	#	Counts from 1 to LPP.
NTOTCD	-	Integer	-	#	Counts the total no. of data cards read
NTYPE(I)	20	Integer	/ALL/	#	The number of type "I" cards that were used in the model; i.e., excludes those that contained errors.

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
NTYPES	-	Integer	-	#	The number of legal Input Format types (excluding "99"). Value = 15
O (=13)	-	Integer	/ALL/	#	Input Format "O": OFF/AIR/CIV Distribution Overrides
OAAMN	-	Real	/O/	%	Distribution override: Training administrative; airman
OACIV	-	Real	/O/	%	Distribution override: Training administrative; civilian
OAHMPM	-	Real	/O/	Man-hrs/Mo	Override of available productive man-hours per month: hardware maintenance
OAOFF	-	Real	/O/	%	Distribution override: Training administrative; officer
OAOMPM	-	Real	/O/	Man-hrs/Mo	Override of available productive man-hours per month: non-hardware maintenance
OATDPM	-	Real	/O/	Days/Mo	Override of average number of training days per month
OBAMN	-	Real	/O/	%	Distribution override: Base operating support; airman
OBCIV	-	Real	/O/	%	Distribution override: Base operating support; civilian

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
OBOFF	-	Real	/O/	%	Distribution override: Base operating support; officer
OCAMN	-	Real	/O/	%	Distribution override: Curriculum; airman
OCCIV	-	Real	/O/	%	Distribution override: Curriculum; civilian
OCOFF	-	Real	/O/	%	Distribution override: Curriculum; officer
OCPMIA	-	Real	/O/	$	Override of PCS cost per move: airmen Instructors
OCPMIC	-	Real	/O/	$	Override of PCS cost per move: civilians Instructors
OCPMIO	-	Real	/O/	$	Override of PCS cost per move: officers Instructors
OCPMSA	-	Real	/O/	$	Override of PCS cost per move: airmen Students

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VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
OCPMSC	-	Real	/O/	$	Override of PCS cost per move: civilians Students
OCPMSO	-	Real	/O/	$	Override of PCS cost per move: officers Students
OFAMN	-	Real	/O/	%	Distribution override: Facility maintenance; airman
OFCIV	-	Real	/O/	%	Distribution override: Facility maintenance; civilian
OFF(I)	10	Real	-	$	Pay Factor Table; officers
OFFAV	-	Real	-	$	Average Pay Factor; officers
OFLAG(I)	34	Alpha	/O1/	-	Contains an * in each position for which an OVRRID(I) value was input

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
OFOFF	-	Real	/O/	%	Distribution override: Facility maintenance; officer
OHAMN	-	Real	/O/	%	Distribution override: Hardware maintenance; airman
OHCIV	-	Real	/O/	%	Distribution override: Hardware maintenance; civilian
OHOFF	-	Real	/O/	%	Distribution override: Hardware maintenance; officer
OMAMN	-	Real	/O/	%	Distribution override: Medical; airman
OMCIV	-	Real	/O/	%	Distribution override: Medical; civilian
OMIL(I)	6	Real	-	Man-yrs.	Non-instructor military man-years in year I
OMOFF	-	Real	/O/	%	Distribution override: Medical; officer
OMSCPM	-	Real	/O/	$	Override of miscellaneous supply cost per man-year
OO (=14)	-	Integer	/ALL/	#	Input Format "OO": Miscellaneous Overrides

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
OTDYAM	-	Real	/O/	$	Override of destination per diem TDY expense: airmen
OTDYCV	-	Real	/O/	$	Override of destination per diem TDY expense: civilians
OTDYOF	-	Real	/O/	$	Override of destination per diem TDY expense: officers
OTDYTC	-	Real	/O/	$	Override of average TDY one way transportation cost
OTHPD	-	Real	/O/	Hrs/Stu/Day	Override of classroom training hours per student per day
OVRRID(I)	34	Real	-	(Various)	EQUIVALENCED to the variable list in /O/ Common
P (=15)	-	Integer	/ALL/	#	Input Format "P": Pay and Allowance Overrides
PAY(I,J)	20x5	Real	/PAY/	$	PAY(I,1): OFF(I) w/overrides PAY(I,2): AMN(I) w/overrides PAY(I,3): CGS(I) w/overrides PAY(I,4): CWB(I) w/overrides PAY(I,5): FOR(I) w/overrides
PAYAV(J)	5	Real	/PAY/	$	PAYAV(1): OFFAV or override PAYAV(2): AMNAV or override PAYAV(3): CGSAV or override PAYAV(4): CWBAV or override PAYAV(5): FORAV or override

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
PCSAMN(K)	5	Real	-	Moves	Number of student airman PCS moves in year "K"
PCSB(I)	6	Real	-	Man-yrs.	Type A man-years for base operating support in year I
PCSCIV(K)	5	Real	-	Moves	Number of student civilian PCS moves in year "K"
PCSM(I)	6	Real	-	Man-yrs.	Type A man-years for medical function in year I
PCSOFF(K)	5	Real	-	Moves	Number of student officer PCS moves in year "K"
PPAF(I)	75	Real	/P/	$	Pay Factor override value
PPD(I)	75	Integer	/P/	#	Personnel Designator on Pay Factor Override Input
PPG(I)	75	Integer	/P/	#	Pay Grade on Pay Factor Override Input
PROC(K)	6	Real	-	#	Hardware procurement quantity in year "K"
QAAMN	-	Real	/Q/	%	Distribution: Training administrative; airman
QACIV	-	Real	/Q/	%	Distribution: Training administrative; civilian

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
QAHMPM	-	Real	/Q/	Man-hrs/Mo	Available productive man-hours per month: hardware maintenance
QAOFF	-	Real	/Q/	%	Distribution: Training administrative; officer
QAOMPM	-	Real	/Q/	Man-hrs/Mo	Available productive man-hours per month: non-hardware maintenance
QATDPM	-	Real	/Q/	Days/Mo	Average number of training days per month
QBAMN	-	Real	/Q/	%	Distribution: Base operating support; airman
QBCIV	-	Real	/Q/	%	Distribution: Base operating support; civilian
QBOFF	-	Real	/Q/	%	Distribution: Base operating support; officer
QCAMN	-	Real	/Q/	%	Distribution: Curriculum; airman
QCCIV	-	Real	/Q/	%	Distribution: Curriculum; civilian
QCOFF	-	Real	/Q/	%	Distribution: Curriculum; officer
QCONST(I)	34	Real	-	(Various)	EQUIVALENCED to the variable list in /Q/ Common

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
QCPMIA	-	Real	/Q/	$	PCS cost per move: airmen Instructors
QCPMIC	-	Real	/Q/	$	PCS cost per move: civilians Instructors
QCPMIO	-	Real	/Q/	$	PCS cost per move: officers Instructors
QCPMSA	-	Real	/Q/	$	PCS cost per move: airmen Students
QCPMSC	-	Real	/Q/	$	PCS cost per move: civilians Students
QCPMSO	-	Real	/Q/	$	PCS cost per move: officers Students
QDR	-	REAL	/Q/	%	Discount Rate
QFAMN	-	Real	/Q/	%	Distribution: Facility maintenance; airman

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
QFCIV	-	Real	/Q/	%	Distribution: Facility maintenance; civilian
QFOFF	-	Real	/Q/	%	Distribution: Facility maintenance; officer
QHAMN	-	Real	/Q/	%	Distribution: Hardware maintenance; airman
QHCIV	-	Real	/Q/	%	Distribution: Hardware maintenance; civilian
QHOFF	-	Real	/Q/	%	Distribution: Hardware maintenance; officer
QMAMN	-	Real	/Q/	%	Distribution: Medical; airman
QMCIV	-	Real	/Q/	%	Distribution: Medical; civilian
QMOFF	-	Real	/Q/	%	Distribution: Medical; officer

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
QMSCPM	-	Real	/Q/	$	Miscellaneous supply cost per man-year
QTDYAM	-	Real	/Q/	$	Destination per diem TDY expense: airmen
QTDYCV	-	Real	/Q/	$	Destination per diem TDY expense: civilians
QTDYOF	-	Real	/Q/	$	Destination per diem TDY expense: officers
QTDYTC	-	Real	/Q/	$	Average TDY one way transportation cost
QTHPD	-	Real	/Q/	Hrs/Stu/Day	Classroom training hours per student per day
R (=6)	-	Integer	/ALL/	#	Input Format "R": Curriculum Manpower Inputs
RID(I)	75	Integer	/R/	#	(see footnote)
RIDX(J)	75	Integer	/R/	#	Input Format 6 Courseware ID#. Must match one of the CID(I).

footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
RIM(I)	75	Integer	/R/	#	(see footnote)
RIMX(J)	75	Integer	/R/	#	Input method for curriculum manpower inputs: 01=calculation 02=thruput
RIPA(I)	75	Real	/R/	%	(see footnote)
RIPAX(J)	75	Real	/R/	%	Percent of courseware development accomplished by instructors
RMPCH(I)	75	Real	/R/	Man-hrs.	(see footnote)
RMPCHX(J)	75	Real	/R/	Man-hrs.	Curriculum man-hours per classroom instruction hour
RNCH(I)	75	Real	/R/	Hrs.	(see footnote)
RNCHX(J)	75	Real	/R/	Hrs.	Number of classroom instruction hours
RNP(K,I)	6x75	Real	/R/	Man-yrs.	(see footnote)
RNPX(K,J)	6x75	Real	/R/	Man-yrs.	Number of curriculum man-years required in year "K"
RVP(I)	25	Real	/F/	%	Residual Value Percent for facility

footnote: Same values as corresponding "X" array, except that the values have been re-arranged to correspond to Procurement ID positions

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
S (=3)	-	Integer	/ALL/	#	Input Format "S": Student Inputs
SENTS(K,I)	7x75	Real	/S/	Entrants	Number of student entrants in year "K"
SFD(I)	75	Real	/H/	#	Stock Fund flag: 1 yes 0,blank no
SIM(I)	75	Integer	/S/	#	Input method for graduates and man-years: 00=calculation , 01=thruput
SMYRS(K,I)	7x75	Real	/S/	Man-Yrs.	Student load in year "K"
SNGRAD(K,I)	7x75	Real	/S/	Graduates	Number of graduates in year "K"
SNWASH(K,I)	7x75	Real	/S/	Washouts	Number of students washing out in year "K"
SPD(I)	75	Integer	/S/	#	Student Personnel Designator: 01=Officer 02=Airman 03=Civilian-GS 04=Civilian-WB 05=Non-DOD
SPG(I)	75	Integer	/S/	#	Student Pay Grade
ST(I)	75	Integer	/S/	#	Student Personnel Type: 01=Active Duty Force Pipeline 02=Active Duty Force Lateral/Upgrade 03=Guard/Reserve Pipeline 04=Guard/Reserve Lateral/Upgrade 05=Other DOD Pipeline 06=Other DOD Lateral/Upgrade 07=Non-DOD

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
T (=4)	-	Integer	/ALL/	#	Input Format "T": Instructor Inputs
TCHRS(I)	5	Real	-	Man-yrs.	Instructor man-years in year I
TDYB(I)	6	Real	-	Man-yrs.	Type B man-years for base operating support in year I
TDYEAM(K)	5	Real	-	Entrants	Number of student airman TDY entrants in year "K"
TDYECV(K)	5	Real	-	Entrants	Number of student civilian TDY entrants in year "K"
TDYEOF(K)	5	Real	-	Entrants	Number of student officer TDY entrants in year "K"
TDYM(I)	6	Real	-	Man-yrs.	Type B man-years for medical function in year I
TDYMAM(K)	5	Real	-	Man-yrs.	Number of student airman TDY man-years in year "K"
TDYMCV(K)	5	Real	-	Man-yrs.	Number of student civilian TDY man-years in year "K"
TDYMOF(K)	5	Real	-	Man-yrs.	Number of student officer TDY man-years in year "K"
TETC(I)	25	Real	/T/	$	Cost of instructor education training per instructor.(Subr. READD)

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VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
TIFTC(I)	25	Real	/T/	$	Cost of initial instructor factory training.(Subr. READD)
TITLE(I)	39	ALPHA	/ALL/	-	Array containing the title (see U)
TN(K,I)	6x25	Real	/T/	Man-yrs.	Number of instructor man-years in year "K" K=1 refers to year 0.(Value =TSIIC(I)*TNMOB/12) K=2 refers to year 1.(Value=input) ... K=6 refers to year 5.(Value=input)
TNMIL(I)	6	Real	-	Man-yrs.	Military instructor man-years in year I
TNMOB(I)	25	Real	/T/	Months	No. of months instructors on board in year 0.(Subr. READD)
TPD(I)	25	Integer	/T/	#	Instructor Personnel Designator: 01=Officer 02=Airman 03=Civilian-GS 04=Civilian-WB
TPG(I)	25	Integer	/T/	#	Instructor Pay Grade
TSIIC(I)	25	Real	/T/	#	Size of initial instructor cadre (year 0) (see TN(K,I))

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
TT(I)	25	Integer	/T/	#	Instructor Personnel Type: 08=Air Force 09=Other DOD
TTR(I)	25	Real	/T/	%	Instructor turnover rate
TURNVR(I)	5	Real	-	Man-yrs.	Instructor turnover in year I
TVR(K)	6	Real	-	%	Instructor turnover rate in year "K" (K=0,...,5)
U (=1)	-	Integer	/ALL/	#	Input Format "U": Title card
UNITS1(I)	5	Real	-	#	Number of required units of printed media in year I for studs.+instrs.
UNITS2(I)	5	Real	-	#	Number of required units of printed media in year I for instructors only

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
V1(I,K)	13x8	Real	/V1/	#	Graduate Summary: # Graduates by Year (OUT1) IROW=1: Active Duty Force, officers 2: airmen 3: civilians 4: Guard and Reserve, officers 5: airmen 6: civilians 7: Other DOD, officers 8: airmen 9: civilians 10: Non-DOD forces 11: Total graduates 12: Total entrants 13: Total washouts

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VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
V2(I,K)	27x7	Real	/V2/	Man-yrs.	Manpower Summary: Man-years by Year (OUT2) IROW=1: Student man-years: Active Duty Force; officer 2: ; airman 3: ; civilian 4: Student man-years: Guard and Reserve; officer 5: ; airman 6: ; civilian 7: Student man-years: Other DOD; officer 8: ; airman 9: ; civilian 10: Student man-years: Non-DOD 11: Total student load 12: Instructor man-years: Air Force 13: : Other DOD 14: Curriculum personnel 15: Hardware maintenance personnel 16: Facilities maintenance personnel 17: Training administrative personnel

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
					18: Base operating support personnel
					19: Medical personnel
					20: Total base permanent party
					21: Total course man-years
					22: Active Duty Force PCS student load
					23: Base permanent party man-years -- AF only
					24: Total Program 8 man-years
					25: Active Duty Force TDY stu. load
					26: Guard and Reserve student load
					27: Total Air Force man-years

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
V4(I,K)	30x7	Real	/V4/	$*K	Functional Cost Summary: $ by Year (OUT4) IROW=1: Courseware procurement: Printed media 2: Courseware procurement: Display media 3: Courseware procurement: Software 4: Hardware procurement: Media hardware 5: Hardware procurement: Special equipment 6: Hardware procurement: Overhead hardware 7: Facility construction 8: Pay and allowances: Students 9: Pay and allowances: Instructors 10: Pay and allowances: Curriculum personnel 11: Pay and allowances: Hardware maintenance personnel 12: Pay and allowances: Facilities maintenance personnel 13: Pay and allowances: Training administrative personnel

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
					14: Pay and allowances: Base operating support personnel
					15: Pay and allowances: Medical personnel
					16: PCS Costs: Students
					17: Instructors
					18: TDY Costs: Transportation
					19: Destination per diem
					20: Factory training of initial instructor cadre
					21: Instructor education training
					22: Computer service charges
					23: Hardware Contract Maintenance
					24: Hardware replenishment repair parts
					25: Personnel supplies
					26: Total course cost
					30: Discounted course cost

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
V5(I,K)	28x7	Real	-	$*K	Program/Appropriation Cost Summary: $ by Year (OUT5) IROW=1: AF Pgm.8 Military Construction 2: AF Pgm.8 Operations and Maintenance; Civilian personnel 3: AF Pgm.8 Operations and Maintenance; Travel of personnel 4: AF Pgm.8 Operations and Maintenance; Printing and reproduction 5: AF Pgm.8 Operations and Maintenance; Other purchased services 6: AF Pgm.8 Operations and Maintenance; Other supplies and equipment. 7: AF Pgm.8 Military Personnel; Officer pay 8: AF Pgm.8 Military Personnel; Airman pay 9: AF Pgm.8 Military Personnel; PCS 10: Total Program 8 11: AF Pgm.5 Operations and Maintenance; Civilian personnel 12: AF Pgm.5 Operations and Maintenance; Civilian PCS/TDY 13: AF Pgm.5 National Guard/Reserve Personnel; Officer pay

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
					14: AF Pgm.5 National Guard/Reserve Personnel; Airman pay
					15: AF Pgm.5 National Guard/Reserve Personnel; Active duty Guard/Reserve PCS/TDY
					16: AF Pgms 1-4,6,7,9,10 Aircraft, missile, other procurement
					17: AF Pgms 1-4,6,7,9,10 Oper. and MTC; Civilian personnel
					18: AF Pgms 1-4,6,7,9,10 Oper. and MTC; Travel of personnel
					19: AF Pgms 1-4,6,7,9,10 Military Personnel; Officer pay
					20: AF Pgms 1-4,6,7,9,10 Military Personnel; Airman pay
					21: Total Air Force
					22: Other DOD Oper. and MTC; Civilian personnel
					23: Other DOD oper. and MTC; Travel of personnel
					24: Other DOD Military Personnel; Officer pay
					25: Other DOD Military Personnel; Airman pay
					26: Other DOD Military Personnel; PCS
					27: Non-DOD
					28: Total Course Cost

VARIABLE DEFINITIONS

VARIABLE	DIMENSION	MODE	COMMON BLOCK	UNITS	DESCRIPTION
WASH(I,J)	7x7	Real	-	Washouts	Number of year "I" entrants washing out in year "J"
XAVFLG(J)	5	Alpha	-	-	Contains an * in any position for which there was an override value in PAYAV(J)
XPFLG(I,J)	20x5	Alpha	-	-	Contains an * in any position for which there was an override value in PAY(I,J)
YESNO(L)	4	Alpha	-	-	YESNO(1-2)="NO" YESNO(3-4)="YES"

COMPUTER REQUIREMENTS

Although the numbers herein were gathered on IBM 370 equipment, the translation to another computer should be roughly the same, assuming an 8-bit character representation and a 4-byte word. The requirements are the following:

- Digital computer with at least 170 K bytes of problem space (exclusive of operating system).
- ANSI (American National Standards Institute) FORTRAN compiler for computer.
- Card reader (80 column card) with a data rate of at least 100 cards per minute.
- High speed printer with 132 character lines and a data rate of at least 200 lines per minute.
- On disk pack, the *load* module requires 170 K bytes of disk space. If the *source* program is to be stored on disk, it will require about 400 K bytes; or, if stored in "Edit" (compressed) format, 146 K bytes.

EXECUTION TIME

The execution time for MODCOM is generally just a few seconds. In particular, the run time for the sample case illustrated in Section IV was 2 CPU seconds.

PROGRAM JCL AND DECK SETUP

CARD ARRANGEMENT TO RUN MODIA COST MODEL ON IBM 370 AT RAND
WITH PROGRAM STORED ON DISK PROGRAM LIBRARY

```
/*
99
                    INPUT DATA CARDS


//GO.SYSIN DD *
// SPACE=(830,(10,10))
// DISP=NEW,DCB=(LRECL=83,BLKSIZE=830,RECFM=FB),
//GO.FT08F001 DD DSN=&&TEMP,UNIT=TEMP,
//GO.FT06F001 DD SYSOUT=A
//GO.FT05F001 DD DDNAME=SYSIN
//STEPLIB DD DSN=libname*, DISP=SHR
// EXEC PGM=CM
//UuuuuRCM JOB (aaaa,149,nn),MODCOM,CLASS=E,REGION=170K

  where:
    Uuuuu = User ID
     aaaa = 4-digit account number
       nn = bin number, or initial of user's last name
```

*At the time of writing, *libname* = K.K0575.A1800.MODIALIB, but the user-account number may well change in the future. If the stated *libname* does not work, please contact the authors or Polly Carpenter-Huffman, at Rand.

CARD ARRANGEMENT TO RUN MODIA COST MODEL ON IBM 370 AT RAND
WITH PROGRAM STORED ON FORTRAN SOURCE CARDS

```
// SPACE=(830,(10,10))
// DISP=NEW,DCB=(LRECL=83,BLKSIZE=830,RECFM=FB),
//GO.FT08F001 DD DSN=&&TEMP,UNIT=TEMP,
/*
99
```

INPUT DATA CARDS

```
//GO.SYSIN DD *
/*
```

FORTRAN SOURCE CARDS

```
//FORT.SYSIN DD *
// EXEC FORTCLG,REGION.GO=170K
//UuuuuRCM JOB (aaaa,149,nn),MODCOM, CLASS=E
```

where:

Uuuuu = User ID
aaaa = 4-digit account number
nn = bin number, or initial of user's last name

```
C
C
C*********************************************************************
C
C             MODIA: THE COST MODEL
C
C             THE RAND CORPORATION
C             SANTA MONICA, CALIFORNIA
C             9 AUG 1977
C
C*********************************************************************
C
C*********************************************************************
C***  STORAGE ALLOCATION - MAIN PROGRAM  ***
C*********************************************************************
C
C
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          ST,SPD,SPG,SIM,
     X          TT,TPD,TPG,
     X          CID,CC,
     X          RIDX,RIMX,RID,RIM,
     X          HID,HC,HOD,
     X          EIDX,EIMX,EID,EIM,
     X          FID,
     X          GIDX,GIMX,GID,GIM,
     X          APT,AIM,
     X          PPD,PPG
C*********************************************************************
C
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          ICDTYP(400), CARD(39),
     X          QCONST(34),
     X          OFF(10),AMN(9),CGS(18),CWB(14),FOR(20),
C
     X          PAY(20,5), PAYAV(5),
     X          XPFLG(20,5), XAVFLG(5)
C
      DIMENSION ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
C
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),
C
     X          CID(75),CC(75),CTYPE(11,75),CCOPY(2,75),CMEAS(3,75),
     X          CNURQ(5,75),CNMU(75),CIPCM(75),CCCM(75),
     X          CPCC(75),CARV(75),CARP(75),
C
     X          RIDX(75),RIMX(75),RID(75),RIM(75),
     X          RNCHX(75),RMPCHX(75),RIPAX(75),RNPX(6,75),
     X          RNCH(75),RMPCH(75),RIPA(75),RNP(6,75),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75)
```

```
C
C
      DIMENSION EIDX(75),EIMX(75),EID(75),EIM(75),
     X          EDURX(5,75),EFRPHX(75),EAVRTX(75),ENPX(5,75),
     X          EDUR(5,75),EFRPH(75),EAVRT(75),ENP(5,75),
C
     X          FID(25),FTYPE(15,25),FCCPU(25),FNURQ(5,25),RVP(25),
C
     X          GIDX(25),GIMX(25),GID(25),GIM(25),
     X          GSFPFX(25),GMPSFX(25),GNPX(5,25),
     X          GSFPF(25),GMPSF(25),GNP(5,25),
C
     X          APT(3),AIM(3),AFMPC(3),AVMPCS(3),
     X          AVMTDY(3),ANP(6,3),
C
     X          BSC(5),
C
     X          PPD(75),PPG(75),PPAF(75),
C
     X          OFLAG(34),OVRRID(34)
C*************************************************************************
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
      COMMON/C/ CID,CC,CTYPE,CCOPY,CMEAS,CNURQ,CNMU,CIPCM,
     X          CCCM,CPCC,CARV,CARP
      COMMON/R/ RIDX,RIMX,RID,RIM,
     X          RNCHX,RMPCHX,RIPAX,RNPX,RNCH,RMPCH,RIPA,RNP
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
      COMMON/E/ EIDX,EIMX,EID,EIM,
     X          EDURX,EFRPHX,EAVRTX,ENPX,EDUR,EFRPH,EAVRT,ENP
      COMMON/F/ FID,FTYPE,FCCPU,FNURQ,RVP
      COMMON/G/ GIDX,GIMX,GID,GIM,
     X          GSFPFX,GMPSFX,GNPX,GSFPF,GMPSF,GNP
      COMMON/A/ APT,AIM,AFMPC,AVMPCS,AVMTDY,ANP
      COMMON/B/ BSC
      COMMON/O/ OCOFF,OCAMN,OCCIV,  OHOFF,OHAMN,OHCIV,
     X          OFOFF,OFAMN,OFCIV,  OAOFF,OAAMN,OACIV,
     X          OBOFF,OBAMN,OBCIV,  OMOFF,OMAMN,OMCIV,
C
     X          OAHMPM,OAOMPM,OATDPM,OTHPD,OMSCPM,
     X          OCPMIO,OCPMIA,OCPMIC,OCPMSO,OCPMSA,OCPMSC,
     X          OTDYTC,OTDYOF,OTDYAM,OTDYCV,DR
      COMMON/O1/ OFLAG
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
      COMMON/P/ PPD,PPG,PPAF
      COMMON/PAY/ PAY, PAYAV
```

```
C
C
C*********************************************************************
C
      EQUIVALENCE (OCOFF,OVRRID(1)), (QCOFF,QCONST(1))
C
C
C*********************************************************************
C *** PROGRAM CONSTANTS ***
C*********************************************************************
C
      DATA STAR/1H*/, BLANK/1H /
C
C
C
C *** PAY FACTOR TABLES (OFFICERS,AIRMEN,CIV-GS,CIV-WB,FOREIGN) ***
C
      DATA OFF(1),OFF(2),OFF(3),OFF(4),OFF(5),OFF(6),
     X     OFF(7),OFF(8),OFF(9),OFF(10)
     X     /10004.,13681.,17876.,20624.,24887.,29384.,
     X      33867.,38385.,40041.,43084./
C
      DATA AMN(1),AMN(2),AMN(3),AMN(4),AMN(5),AMN(6),
     X     AMN(7),AMN(8),AMN(9)
     X     / 5430., 6027., 6579., 7791., 9583.,11201.,
     X      12779.,14638.,17002./
C
      DATA CGS(1),CGS(2),CGS(3),CGS(4),CGS(5),CGS(6),
     X     CGS(7),CGS(8),CGS(9),CGS(10),CGS(11),CGS(12),
     X     CGS(13),CGS(14),CGS(15),CGS(16),CGS(17),CGS(18)
     X     / 5651., 6447., 7953., 9266.,10483.,11782.,
     X      13828.,14254.,15717.,17041.,18935.,22285.,
     X      28053.,30377.,35823.,39060.,39060.,39060./
C
      DATA CWB(1),CWB(2),CWB(3),CWB(4),CWB(5),CWB(6),
     X     CWB(7),CWB(8),CWB(9),CWB(10),CWB(11),CWB(12),
     X     CWB(13),CWB(14)
     X     / 7912., 8491., 8896., 9214., 9587.,10527.,
     X      11077.,11471.,12124.,12758.,13373.,13845.,
     X      14776.,15157./
      DATA OFFAV/18297./,AMNAV/ 8551./,CGSAV/12599./,CWBAV/11464./,
     X     FORAV/    0./
C
      CALL INITF(FOR,20)
C
C
C
C *** MISCELLANEOUS PROGRAM CONSTANTS (SEE BLOCK DATA SUBPROGRAM) ***
C
C
```

```
C
C
C*****************************************************************
C***  INITIALIZATION - MAIN PROGRAM  ***
C*****************************************************************
C
9000  CONTINUE
      NTOTCD = 0
      NCARDS = 0
      U = 1
      D = 2
      S = 3
      T = 4
      C = 5
      R = 6
      H = 7
      E = 8
      F = 9
      G = 10
      A = 11
      B = 12
      O = 13
      OO= 14
      P = 15
      NTYPES = 15
      CALL INITI(NITYPE,20)
      CALL INITI(NTYPE,20)
      IPAGE = 0
      NLINES = 0
      LPP = 55
      CALL INITF(PAY,100)
      CALL INITA(XPFLG,100)
      CALL INITA(XAVFLG,5)
C
C  *** INITIALIZE ALL INPUT VARS. TO 0 ***
C
      DGCD = 0.
      DWR  = 0.
      DWCD = 0.
      DEI=0.
C*****************************************************************
C
      CALL INITI(ST,75)
      CALL INITI(SPD,75)
      CALL INITI(SPG,75)
      CALL INITI(SIM,75)
      CALL INITF(SNGRAD,525)
      CALL INITF(SMYRS,525)
      CALL INITF(SENTS,525)
      CALL INITF(SNWASH,525)
C*****************************************************************
      CALL INITI(TT,25)
C
      CALL INITI(TPD,25)
      CALL INITI(TPG,25)
      CALL INITF(TSIIC,25)
      CALL INITF(TN,150)
      CALL INITF(TTR,25)
```

```
C
C
C*************************************************************************
C
      CALL INITI(CID,75)
      CALL INITI(CC,75)
      CALL INITA(CTYPE,825)
      CALL INITA(CCOPY,150)
      CALL INITA(CMEAS,225)
      CALL INITF(CNURQ,375)
      CALL INITF(CNMU,75)
      CALL INITF(CIPCM,75)
      CALL INITF(CCCM,75)
      CALL INITF(CPCC,75)
      CALL INITF(CARV,75)
      CALL INITF(CARP,75)
C*************************************************************************
C
      CALL INITI(RIDX,75)
      CALL INITI(RIMX,75)
      CALL INITI(RID,75)
      CALL INITI(RIM,75)
      CALL INITF(RNCHX,75)
      CALL INITF(RMPCHX,75)
      CALL INITF(RIPAX,75)
      CALL INITF(RNPX,450)
      CALL INITF(RNCH,75)
      CALL INITF(RMPCH,75)
      CALL INITF(RIPA,75)
      CALL INITF(RNP,450)
C*************************************************************************
C
      CALL INITI(HID,75)
      CALL INITI(HC,75)
      CALL INITI(HOD,75)
      CALL INITA(HTYPE,1125)
      CALL INITF(HNURQ,375)
      CALL INITF(SFD,75)
      CALL INITF(CRV,75)
      CALL INITF(HCMTC,75)
      CALL INITF(HPCU,75)
      CALL INITF(HAAF,75)
      CALL INITF(HRCUY,75)
      CALL INITF(HISR,75)
C*************************************************************************
C
      CALL INITI(EIDX,75)
      CALL INITI(EIMX,75)
      CALL INITI(EID,75)
      CALL INITI(EIM,75)
      CALL INITF(EDURX,375)
      CALL INITF(EFRPHX,75)
      CALL INITF(EAVRTX,75)
      CALL INITF(ENPX,375)
      CALL INITF(EDUR,375)
      CALL INITF(EFRPH,75)
      CALL INITF(EAVRT,75)
      CALL INITF(ENP,375)
```

```
C
C
C*************************************************************************
C
      CALL INITI(FID,25)
      CALL INITA(FTYPE,375)
      CALL INITF(FCCPU,25)
      CALL INITF(FNURQ,125)
      CALL INITF(RVP,25)
C*************************************************************************
C
      CALL INITI(GIDX,25)
      CALL INITI(GIMX,25)
      CALL INITI(GID,25)
      CALL INITI(GIM,25)
      CALL INITF(GSFPFX,25)
      CALL INITF(GMPSFX,25)
      CALL INITF(GNPX,125)
      CALL INITF(GSFPF,25)
      CALL INITF(GMPSF,25)
      CALL INITF(GNP,125)
C*************************************************************************
C
      CALL INITI(APT,3)
      CALL INITI(AIM,3)
      CALL INITF(AFMPC,3)
      CALL INITF(AVMPCS,3)
      CALL INITF(AVMTDY,3)
      CALL INITF(ANP,18)
C*************************************************************************
C
      CALL INITF(BSC,5)
C*************************************************************************
C
      CALL INITA(OFLAG,34)
C*************************************************************************
C
```

```
C
C
C*********************************************************************
C***  MAIN CONTROL PROGRAM  ***
C*********************************************************************
C
C  READ INPUT DATA(MAY BE OUT OF SORT), PRINT IT, WRITE IT ON UNIT 8.
C
10000 READ(5,10010)ITYPE,CARD
10010 FORMAT(I2,39A2)
      NTOTCD = NTOTCD+1
      IF(ITYPE .NE. U)GO TO 10018
C HEADING CARD. REPLACE DEFAULT TITLE.
      DO 10015 I=1,39
      TITLE(I) = CARD(I)
10015 CONTINUE
      NITYPE(U) = NITYPE(U)+1
10018 CONTINUE
      IF(NLINES .GE. LPP .OR. NLINES .EQ. 0) CALL TITLE1
      WRITE(6,10020)NTOTCD,ITYPE,CARD
10020 FORMAT(5X,I3,1H.,3X,I2,39A2)
      NLINES = NLINES+1
C 99 IN COLS. 1-2 IS END-OF-DATA FLAG.
      IF(ITYPE .GT. 98)GO TO 11000
C CHECK FOR ILLEGAL CARD TYPE. LEGAL RANGE IS 01-NTYPES.
10025 CONTINUE
      IF(ITYPE .GE. 1 .AND. ITYPE .LE. NTYPES) GO TO 10030
      CALL ERROR(1,NTOTCD,NTYPES)
      GO TO 10000
10030 NCARDS = NCARDS+1
      IF(ITYPE .NE. U) NITYPE(ITYPE) = NITYPE(ITYPE)+1
      ICDTYP(NCARDS) = ITYPE
      WRITE(8,10040)ITYPE,CARD,NTOTCD
10040 FORMAT(I2,39A2,I3)
      GO TO 10000
C*********************************************************************
C END OF INPUT DATA.
C    NOW READ IT BACK FROM UNIT 8, WITH APPROPRIATE FORMAT.
C
11000 NTOTCD = NTOTCD-1
      REWIND 8
      NLINES = 0
      DO 11900 I=1,NCARDS
      ITYP = ICDTYP(I)
      GO TO (11010,11020,11030,11040,11050,11060,11070,11080,11090,
     1   11100,11110,11120,11130,11140,11150),ITYP
C HEADING CARD. SKIP OVER IT.
11010 READ(8,11015)
11015 FORMAT(1X)
      GO TO 11900
C COURSE DURATION AND INSTRUCTOR TRAINING FACTORS CARD
11020 CALL READD
      GO TO 11900
```

```
C
C
C STUDENT INPUTS
11030 CALL READS
      GO TO 11900
C INSTRUCTOR INPUTS
11040 CALL READT
      GO TO 11900
C COURSEWARE PROCUREMENT INPUTS
11050 CALL READC
      GO TO 11900
C CURRICULUM MANPOWER INPUTS
11060 CALL READR
      GO TO 11900
C HARDWARE PROCUREMENT INPUTS
11070 CALL READH
      GO TO 11900
C HARDWARE MTC MANPOWER INPUTS
11080 CALL READE
      GO TO 11900
C FACILITY PROCUREMENT INPUTS
11090 CALL READF
      GO TO 11900
C FACILITIES MTC MANPOWER INPUTS
11100 CALL READG
      GO TO 11900
C TRAINING ADMINISTRATIVE,BASE OPERS.,AND MEDICAL PERSONNEL INPUTS
11110 CALL READA
      GO TO 11900
C COMPUTER SERVICE CHARGES
11120 CALL READB
      GO TO 11900
C OFF/AIR/CIV DISTRIBUTION OVERRIDES
11130 CALL READO
      GO TO 11900
C MISCELLANEOUS OVERRIDES
11140 CALL READOO
      GO TO 11900
C PAY AND ALLOWANCE OVERRIDES
11150 CALL READP
      GO TO 11900
11900 CONTINUE
      GO TO 18000
C
```

```
C
C
C*************************************************************************
C ***  CLEAN UP BEFORE GENERATING OUTPUT REPORTS  ***
C*************************************************************************
C
18000 CONTINUE
      IF(DGCD .GT. 0.0)GO TO 18025
C NO LEGAL COURSE DURATION CARD FOUND. TERMINATE JOB.
      CALL ERROR(42,IDUMMY,IDUMMY)
      STOP
18025 IF(DEI .GT. 0.)GO TO 18050
C  STUDENT ENTRY INTERVAL = 0.  TERMINATE JOB.
      CALL ERROR(29,IDUMMY,IDUMMY)
      STOP
18050 CONTINUE
C
C *** MOVE PAY FACTORS FROM TABLES TO PAY MATRIX ***
C
      DO 18100 I=1,10
      PAY(I,1) = OFF(I)
18100 CONTINUE
      PAYAV(1) = OFFAV
      DO 18200 I=1,9
      PAY(I,2) = AMN(I)
18200 CONTINUE
      PAYAV(2) = AMNAV
      DO 18300 I=1,18
      PAY(I,3) = CGS(I)
18300 CONTINUE
      PAYAV(3) = CGSAV
      DO 18400 I=1,14
      PAY(I,4) = CWB(I)
18400 CONTINUE
      PAYAV(4) = CWBAV
      DO 18500 I=1,20
      PAY(I,5) = FOR(I)
18500 CONTINUE
      PAYAV(5) = FORAV
C
C       REPLACE WITH OVERRIDE VALUES, IF ANY
C
      IF(NTYPE(P) .EQ. 0) GO TO 18700
      N = NTYPE(P)
      DO 18600 K=1,N
      J = PPD(K)
      I = PPG(K)
      IF(I .GT. 0)GO TO 18550
C
C OVERRIDE AVERAGE, AND SET ASTERISK
      XAVFLG(J) = STAR
      PAYAV(J) = PPAF(K)
      GO TO 18600
C
```

```
C
C
C OVERRIDE MATRIX VALUE, AND SET ASTERISK
18550 XPFLG(I,J) = STAR
      PAY(I,J) = PPAF(K)
18600 CONTINUE
18700 CONTINUE
C
      CALL PRINT2(PAY, PAYAV, XPFLG, XAVFLG )
C
C
C *** OVERRIDE MISC. PROGRAM CONSTANTS WITH INPUT VALUES, IF ANY ***
C
      DO 19100 I=1,34
      IF(OFLAG(I) .EQ. BLANK)GO TO 19100
      QCONST(I) = OVRRID(I)
19100 CONTINUE
C
      CALL PRINT1 (QCONST, OFLAG)
C
C  A12 = NO. HRS. IN 12 MOS.
C  A24 = NO. HRS. IN 24 MOS.
      A12 = QATDPM*QTHPD*12.
      A24 = 2.*A12
C
C  IF COURSE DURATION .GE. 20 WEEKS, IFLAG=1.  ELSE IFLAG=0.
C
      IF(DGCD .GE. QATDPM*QTHPD*4.61)IFLAG=1
      IF(DGCD .LT. QATDPM*QTHPD*4.61)IFLAG=0
C
      IF(DGCD.LE.A24)GO TO 19200
C ERROR.  GRADUATE COURSE DURATION EXCEEDS 2 YEARS.
      CALL ERROR(44,IDUM,IDUM)
      STOP
19200 IF(DWCD.LE.A12)GO TO 19300
C ERROR.  WASHOUT COURSE DURATION EXCEEDS 1 YEAR.
      CALL ERROR(45,IDUM,IDUM)
      STOP
19300 CONTINUE
C
C
C       COMPUTE STUDENT GRADUATES, MAN-YEARS, WASHOUTS FOR YEARS 1-6
C            (WHERE YEAR 6 MEANS "IN PROGRESS")
C
      IF(NTYPE(S) .EQ. 0)GO TO 14900
C
C
      CALL SPHASE
C
C
14900 CONTINUE
C
```

```
C
C
C COMPUTE INSTRUCTOR MAN-YEARS IN YEAR 0
C
C
      IF(NTYPE(T).EQ.0)GO TO 14975
      NT=NTYPE(T)
      DO 14925 K=1,NT
      TN(1,K)=TSIIC(K)*TNMOB(K)/12.
14925 CONTINUE
14975 CONTINUE
C
C**********************************************************************
C
C *** MOVE MANPOWER INPUTS TO CORRESPONDING PROCUREMENT ID POSITIONS ***
C
C     * CURRICULUM *
C
      IF(NTYPE(R) .EQ. 0)GO TO 15900
15000 N1 = NTYPE(C)
      N2 = NTYPE(R)
      DO 15100 I2=1,N2
      DO 15100 I1=1,N1
      IF(RIDX(I2) .NE. CID(I1)) GO TO 15100
C MOVE CURRICULUM MANPOWER INPUTS
      RID(I1) = RIDX(I2)
      RIM(I1) = RIMX(I2)
      RNCH(I1) = RNCHX(I2)
      RMPCH(I1) = RMPCHX(I2)
      RIPA(I1) = RIPAX(I2)
      DO 15090 J=1,6
      RNP(J,I1) = RNPX(J,I2)
15090 CONTINUE
15100 CONTINUE
15900 CONTINUE
C
C     * HARDWARE *
C
      IF(NTYPE(E) .EQ. 0)GO TO 16900
16000 N1 = NTYPE(H)
      N2 = NTYPE(E)
      DO 16100 I2=1,N2
      DO 16100 I1=1,N1
      IF(EIDX(I2) .NE. HID(I1)) GO TO 16100
C MOVE HARDWARE MANPOWER INPUTS
      EID(I1) = EIDX(I2)
      EIM(I1) = EIMX(I2)
      EFRPH(I1) = EFRPHX(I2)
      EAVRT(I1) = EAVRTX(I2)
      DO 16090 J=1,5
      ENP(J,I1) = ENPX(J,I2)
      EDUR(J,I1) = EDURX(J,I2)
16090 CONTINUE
16100 CONTINUE
16900 CONTINUE
```

```
C
C
C     * FACILITIES *
C
      IF(NTYPE(G) .EQ. 0)GO TO 17900
17000 N1 = NTYPE(F)
      N2 = NTYPE(G)
      DO 17100 I2=1,N2
      DO 17100 I1=1,N1
      IF(GIDX(I2) .NE. FID(I1)) GO TO 17100
C MOVE FACILITY MANPOWER INPUTS
      GID(I1) = GIDX(I2)
      GIM(I1) = GIMX(I2)
      GSFPF(I1) = GSFPFX(I2)
      GMPSF(I1) = GMPSFX(I2)
      DO 17090 J=1,5
      GNP(J,I1) = GNPX(J,I2)
17090 CONTINUE
17100 CONTINUE
C*****************************************************************
C*****************************************************************
17900 CONTINUE
C
      CALL OUT1
C
      CALL OUT2
C
      CALL OUT3
C
      CALL OUT4
C
      CALL OUT5
C
      CALL OUT6
C
      CALL OUT7
C
      CALL OUT8
C
      STOP
      END
```

```
C
C
C*****************************************************************
C*** COURSE DURATION  CARD ***
C*****************************************************************
      SUBROUTINE READD
      INTEGER   DCARD1,DCARD2,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),TCARD(25)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
C
      IF(NTYPE(D) .NE. 0) GO TO 120
      READ(8,110) DGCD,DWR,DWCD,DEI,DCARD1
110   FORMAT(2X,4F4.0,62X,I3)
      GO TO 190
C  MORE THAN ONE COURSE DURATION CARD.  THIS CARD IS IGNORED.
120   READ(8,130) DCARD2
130   FORMAT(80X,I3)
      CALL ERROR(2,DCARD1,DCARD2)
190   NTYPE(D) = 1
      RETURN
      END
```

```
C
C
C*********************************************************************
C *** STUDENT INPUTS ***
C*********************************************************************
      SUBROUTINE READS
      INTEGER   ST,SPD,SPG,SIM,SCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
     X          SCARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(S) .GT. 0)GO TO 200
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
200   K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 205
C TOO MANY STUDENT INPUTS. OMIT CARD.
      READ(8,203)ICDNO
203   FORMAT(80X,I3)
      CALL ERROR(43,S,ICDNO)
      K = K-1
      GO TO 290
205   READ(8,210) ST(K),SPD(K),SPG(K),SIM(K),(SENTS(J,K),J=1,5),
     1 (SNGRAD(J,K),J=1,6),(SMYRS(J,K),J=1,5),SCARD(K)
210   FORMAT(2X,3I2,I1,16F4.0,7X,I3)
C*********************************************************************
220   IF(SPD(K) .GE. 1 .AND. SPD(K) .LE. 5)GO TO 225
C  ILLEGAL STUDENT PERSONNEL DESIGNATOR.  OMIT CARD.
      CALL ERROR(3,IDUMMY,SCARD(K))
      K = K-1
      GO TO 290
225   IF(ST(K) .GE. 1 .AND. ST(K) .LE. 7)GO TO 230
C  ILLEGAL STUDENT TYPE.  OMIT CARD.
      CALL ERROR(4,IDUMMY,SCARD(K))
      K = K-1
      GO TO 290
C CHECK FOR ILLEGAL PERSONNEL DESIGNATOR-PAY GRADE PAIR
230   IF(SPD(K) .EQ. 1 .AND. SPG(K) .GE. 0
     1       .AND. SPG(K) .LE. 10)GO TO 235
      IF(SPD(K) .EQ. 2 .AND. SPG(K) .GE. 0
     1       .AND. SPG(K) .LE. 9)GO TO 235
      IF(SPD(K) .EQ. 3 .AND. SPG(K) .GE. 0
     1       .AND. SPG(K) .LE. 18)GO TO 235
      IF(SPD(K) .EQ. 4 .AND. SPG(K) .GE. 0
     1       .AND. SPG(K) .LE. 14)GO TO 235
      IF(SPD(K) .EQ. 5)GO TO 235
C ILLEGAL PAIR FOUND
      CALL ERROR(26,IDUMMY,SCARD(K))
      K = K-1
      GO TO 290
```

```
C
C
C  CHECK FOR DUPLICATE STUDENT TYPE-PERS. DESIGNATOR-PAY GRADE
235    IF(K .EQ. 1)GO TO 250
       DO 240 I=1,K1
       IF(ST(K) .EQ. ST(I) .AND. SPD(K) .EQ. SPD(I)
      1    .AND. SPG(K) .EQ. SPG(I))GO TO 245
240    CONTINUE
       GO TO 250
C DUPLICATE FOUND.  OMIT CARD.
245    CALL ERROR(5,SCARD(I),SCARD(K))
       K = K-1
       GO TO 290
250    IF(SIM(K) .EQ. 2 .OR. SIM(K) .EQ. 1)GO TO 260
C ILLEGAL VALUE IN STUDENT "INPUT METHOD". OMIT CARD.
       CALL ERROR(31,IDUMMY,SCARD(K))
       K = K-1
       GO TO 290
C MAKE SURE THAT IF ST=7 THEN SPD=5, AND VICE VERSA (FOREIGN STUDENT)
260    IF((ST(K) .EQ. 7 .AND. SPD(K) .EQ. 5)  .OR.
      1    (ST(K) .NE. 7 .AND. SPD(K) .NE. 5)) GO TO 290
       CALL ERROR(39,IDUMMY,SCARD(K))
       K = K-1
       GO TO 290
C*************************************************************************
290    NTYPE(S) = K
C  ROUND AND TRUNCATE ENTRANTS, NO. GRADS.
       DO 295 J=1,6
       SENTS(J,K) = ROUNDO(SENTS(J,K))
       SNGRAD(J,K) = ROUNDO(SNGRAD(J,K))
295    CONTINUE
C
       RETURN
       END
```

```
C
C
C*********************************************************************
C *** INSTRUCTOR INPUTS ***
C*********************************************************************
      SUBROUTINE READT
      INTEGER   TT,TPD,TPG,TCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),TCARD(25)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(T) .GT. 0)GO TO 300
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
300   K = K+1
      K1 = K-1
      IF(K .LE. 25)GO TO 305
C TOO MANY INSTRUCTOR INPUTS. OMIT CARD.
      READ(8,303)ICDNO
303   FORMAT(80X,I3)
      CALL ERROR(43,T,ICDNO)
      K = K-1
      GO TO 390
305   READ(8,310)TT(K),TPD(K),TPG(K),TSIIC(K),TNMOB(K),(TN(J,K),J=2,6),
     1 TTR(K),TIFTC(K),TETC(K),TCARD(K)
310   FORMAT(2X,3I2,F5.0,F4.0,5F5.0,F3.0,F6.0,F5.0,24X,I3)
C*********************************************************************
      IF(TPD(K) .GE. 1 .AND. TPD(K) .LE. 4)GO TO 315
C ILLEGAL INSTRUCTOR PERSONNEL DESIGNATOR.  OMIT CARD.
      CALL ERROR(6,IDUMMY,TCARD(K))
      K = K-1
      GO TO 390
C CHECK FOR ILLEGAL PERSONNEL DESIGNATOR-PAY GRADE PAIR
315   IF(TPD(K) .EQ. 1 .AND. TPG(K) .GE. 0
     1       .AND. TPG(K) .LE. 10)GO TO 320
      IF(TPD(K) .EQ. 2 .AND. TPG(K) .GE. 0
     1       .AND. TPG(K) .LE. 9)GO TO 320
      IF(TPD(K) .EQ. 3 .AND. TPG(K) .GE. 0
     1       .AND. TPG(K) .LE. 18)GO TO 320
      IF(TPD(K) .EQ. 4 .AND. TPG(K) .GE. 0
     1       .AND. TPG(K) .LE. 14)GO TO 320
C ILLEGAL PAIR FOUND
      CALL ERROR(27,IDUMMY,TCARD(K))
      K = K-1
      GO TO 390
```

```
C
C
C  CHECK FOR DUPLICATE INSTRUCTOR TYPE-PERSONNEL DESIGNATOR-PAY GRADE
320    IF(K .EQ. 1)GO TO 350
       DO 330 I=1,K1
       IF(TT(K) .EQ. TT(I) .AND. TPD(K) .EQ. TPD(I)
      1                    .AND. TPG(K) .EQ. TPG(I)) GO TO 340
330    CONTINUE
       GO TO 350
C DUPLICATE FOUND.  OMIT CARD.
340    CALL ERROR(7,TCARD(I),TCARD(K))
       K = K-1
       GO TO 390
350    IF(TT(K) .EQ. 8 .OR. TT(K) .EQ. 9)GO TO 390
C ILLEGAL INSTRUCTOR TYPE. OMIT CARD.
       CALL ERROR(32,IDUMMY,TCARD(K))
       K = K-1
       GO TO 390
C*****************************************************************************
390    NTYPE(T) = K
       RETURN
       END
```

```
C
C
C*************************************************************************
C *** COURSEWARE PROCUREMENT INPUTS ***
C*************************************************************************
      SUBROUTINE READC
      INTEGER   CID,CC,CCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          CID(75),CC(75),CTYPE(11,75),CCOPY(2,75),CMEAS(3,75),
     X          CNURQ(5,75),CNMU(75),CIPCM(75),CCCM(75),
     X          CPCC(75),CARV(75),CARP(75),CCARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/C/ CID,CC,CTYPE,CCOPY,CMEAS,CNURQ,CNMU,CIPCM,
     X          CCCM,CPCC,CARV,CARP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(C) .GT. 0)GO TO 400
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
400   K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 405
C TOO MANY COURSEWARE PROCUREMENT INPUTS. OMIT CARD.
      READ(8,403)ICDNO
403   FORMAT(80X,I3)
      CALL ERROR(43,C,ICDNO)
      K = K-1
      GO TO 490
405   READ(8,410) CID(K),CC(K),(CTYPE(J,K),J=1,11),(CCOPY(J,K),J=1,2),
     1 (CMEAS(J,K),J=1,3),(CNURQ(J,K),J=1,5),CNMU(K),CIPCM(K),CCCM(K),
     2 CPCC(K),CARV(K),CARP(K),CCARD(K)
410   FORMAT(2X,I2,I1,11A2,2A2,3A2,5F4.0,F4.0,F5.0,2F4.0,2F3.0,I3)
C*************************************************************************
      IF(CID(K) .GT. 0)GO TO 420
C COURSEWARE ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(8,IDUMMY,CCARD(K))
      K = K-1
      GO TO 490
C  CHECK FOR DUPLICATE COURSEWARE ID
420   IF(K .EQ. 1)GO TO 450
      DO 430 I=1,K1
      IF(CID(K) .EQ. CID(I))GO TO 440
430   CONTINUE
      GO TO 450
C DUPLICATE FOUND.  OMIT CARD.
440   CALL ERROR(9,CCARD(I),CCARD(K))
      K = K-1
      GO TO 490
450   IF(CC(K) .GE. 1 .AND. CC(K) .LE. 4)GO TO 490
```

```
C
C
C ILLEGAL COURSEWARE SUB-CLASS. OMIT CARD.
      CALL ERROR(33,IDUMMY,CCARD(K))
      K = K-1
      GO TO 490
C*****************************************************************************
490   NTYPE(C) = K
C ROUND AND TRUNCATE NO. UNITS REQUIRED
      DO 495 J=1,5
      CNURQ(J,K) = ROUND0(CNURQ(J,K))
495   CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** CURRICULUM MANPOWER INPUTS ***
C*************************************************************************
      SUBROUTINE READR
      INTEGER   RIDX,RIMX,RID,RIM,RCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          RIDX(75),RIMX(75),RID(75),RIM(75),
     X          RNCHX(75),RMPCHX(75),RIPAX(75),RNPX(6,75),
     X          RNCH(75),RMPCH(75),RIPA(75),RNP(6,75),RCARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/R/ RIDX,RIMX,RID,RIM,
     X          RNCHX,RMPCHX,RIPAX,RNPX,RNCH,RMPCH,RIPA,RNP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(R) .GT. 0)GO TO 500
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
500   K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 505
C TOO MANY CURRICULUM MANPOWER INPUTS. OMIT CARD.
      READ(8,503)ICDNO
503   FORMAT(80X,I3)
      CALL ERROR(43,R,ICDNO)
      K = K-1
      GO TO 590
505   READ(8,510) RIDX(K),RIMX(K),RNCHX(K),RMPCHX(K),RIPAX(K),
     1 (RNPX(J,K),J=1,6),RCARD(K)
510   FORMAT(2X,2I2,2F5.0,F3.0,6F4.0,37X,I3)
C*************************************************************************
      IF(RIDX(K) .GT. 0)GO TO 520
C COURSEWARE ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(10,IDUMMY,RCARD(K))
      K = K-1
      GO TO 590
C  CHECK FOR DUPLICATE COURSEWARE ID
520   IF(K .EQ. 1)GO TO 550
      DO 530 I=1,K1
      IF(RIDX(K) .EQ. RIDX(I))GO TO 540
530   CONTINUE
      GO TO 550
C DUPLICATE FOUND.  OMIT CARD.
540   CALL ERROR(11,RCARD(I),RCARD(K))
      K = K-1
      GO TO 590
550   IF(RIMX(K) .EQ. 1 .OR. RIMX(K) .EQ. 2)GO TO 590
C ILLEGAL VALUE FOR INPUT METHOD. MUST EQUAL 01,02. OMIT CARD.
      CALL ERROR(34,IDUMMY,RCARD(K))
      K = K-1
      GO TO 590
C*************************************************************************
590   NTYPE(R) = K
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** HARDWARE PROCUREMENT INPUTS ***
C*************************************************************************
      SUBROUTINE READH
      INTEGER   HID,HC,HOD,HCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75),HCARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(H) .GT. 0)GO TO 600
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
600   K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 605
C TOO MANY HARDWARE PROCUREMENT INPUTS. OMIT CARD.
      READ(8,603)ICDNO
603   FORMAT(80X,I3)
      CALL ERROR(43,H,ICDNO)
      K = K-1
      GO TO 690
605   READ(8,610) HID(K),HC(K),(HTYPE(J,K),J=1,13),(HNURQ(J,K),J=1,5),
     1 HPCU(K),SFD(K),CRV(K),HCMTC(K),HAAF(K),HRCUY(K),HISR(K),HCARD(K)
610   FORMAT(2X,I2,I1,12A2,A1,5F4.0,F8.0,F1.0,F3.0,F6.0,F3.0,F6.0,F3.0,
     1 I3)
C*************************************************************************
      IF(HID(K) .GT. 0)GO TO 620
C  HARDWARE ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(12,IDUMMY,HCARD(K))
      K = K-1
      GO TO 690
C  CHECK FOR DUPLICATE HARDWARE ID
620   IF(K .EQ. 1)GO TO 650
      DO 630 I=1,K1
      IF(HID(K) .EQ. HID(I))GO TO 640
630   CONTINUE
      GO TO 650
C DUPLICATE FOUND.  OMIT CARD.
640   CALL ERROR(13,HCARD(I),HCARD(K))
      K = K-1
      GO TO 690
650   IF(HC(K) .GE. 1 .AND. HC(K) .LE. 3)GO TO 690
C ILLEGAL HARDWARE SUB-CLASS. OMIT CARD.
      CALL ERROR(35,IDUMMY,HCARD(K))
      K = K-1
```

```
C
C
C*************************************************************************
690    NTYPE(H) = K
C ROUND AND TRUNCATE NO. UNITS REQUIRED
       DO 695 J=1,5
       HNURQ(J,K) = ROUNDO(HNURQ(J,K))
695    CONTINUE
       RETURN
       END
```

```
C
C
C*************************************************************************
C *** HARDWARE MTC MANPOWER INPUTS ***
C*************************************************************************
      SUBROUTINE READE
      INTEGER   EIDX,EIMX,EID,EIM,ECARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          EIDX(75),EIMX(75),EID(75),EIM(75),
     X          EDURX(5,75),EFRPHX(75),EAVRTX(75),ENPX(5,75),
     X          EDUR(5,75),EFRPH(75),EAVRT(75),ENP(5,75),ECARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/E/ EIDX,EIMX,EID,EIM,
     X          EDURX,EFRPHX,EAVRTX,ENPX,EDUR,EFRPH,EAVRT,ENP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(E) .GT. 0)GO TO 700
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
700   K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 705
C TOO MANY HARDWARE MANPOWER INPUTS. OMIT CARD.
      READ(8,703)ICDNO
703   FORMAT(80X,I3)
      CALL ERROR(43,E,ICDNO)
      K = K-1
      GO TO 790
705   READ(8,710) EIDX(K),EIMX(K),(EDURX(J,K),J=1,5),EFRPHX(K),
     1 EAVRTX(K),(ENPX(J,K),J=1,5),ECARD(K)
710   FORMAT( 2X,2I2,5F4.0,F6.0,F5.0,5F4.0,23X,I3)
C*************************************************************************
      IF(EIDX(K) .GT. 0)GO TO 720
C HARDWARE ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(14,IDUMMY,ECARD(K))
      K = K-1
      GO TO 790
C  CHECK FOR DUPLICATE HARDWARE ID
720   IF(K .EQ. 1)GO TO 750
      DO 730 I=1,K1
      IF(EIDX(K) .EQ. EIDX(I))GO TO 740
730   CONTINUE
      GO TO 750
C DUPLICATE FOUND.  OMIT CARD.
740   CALL ERROR(15,ECARD(I),ECARD(K))
      K = K-1
      GO TO 790
750   IF(EIMX(K) .EQ. 1 .OR. EIMX(K) .EQ. 2)GO TO 790
C ILLEGAL VALUE FOR INPUT METHOD. MUST EQUAL 1 OR 2. OMIT CARD.
      CALL ERROR(36,IDUMMY,ECARD(K))
      K = K-1
      GO TO 790
C*************************************************************************
790   NTYPE(E) = K
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** FACILITY PROCUREMENT INPUTS ***
C*************************************************************************
      SUBROUTINE READF
      INTEGER   FID,FCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          FID(25),FTYPE(15,25),FCCPU(25),FNURQ(5,25),RVP(25),
     X          FCARD(25)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/F/ FID,FTYPE,FCCPU,FNURQ,RVP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(F) .GT. 0)GO TO 800
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
800   K = K+1
      K1 = K-1
      IF(K .LE. 25)GO TO 805
C TOO MANY FACILITY PROCUREMENT INPUTS. OMIT CARD.
      READ(8,803)ICDNO
803   FORMAT(80X,I3)
      CALL ERROR(43,F,ICDNO)
      K = K-1
      GO TO 890
805   READ(8,810)FID(K), (FTYPE(J,K),J=1,15),
     1 (FNURQ(J,K),J=1,5),  FCCPU(K),RVP(K), FCARD(K)
810   FORMAT(2X,I2,15A2,5F4.0,F8.0,F4.0,14X,I3)
C*************************************************************************
      IF(FID(K) .GT. 0)GO TO 820
C  FACILITY ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(16,IDUMMY,FCARD(K))
      K = K-1
      GO TO 890
C  CHECK FOR DUPLICATE FACILITY ID
820   IF(K .EQ. 1)GO TO 890
      DO 830 I=1,K1
      IF(FID(K) .EQ. FID(I))GO TO 840
830   CONTINUE
      GO TO 890
C DUPLICATE FOUND.  OMIT CARD.
840   CALL ERROR(17,FCARD(I),FCARD(K))
      K = K-1
      GO TO 890
C*************************************************************************
890   NTYPE(F) = K
C ROUND AND TRUNCATE NO. UNITS REQUIRED
      DO 895 J=1,5
      FNURQ(J,K) = ROUND0(FNURQ(J,K))
895   CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** FACILITIES MTC MANPOWER INPUTS ***
C*************************************************************************
      SUBROUTINE READG
      INTEGER   GIDX,GIMX,GID,GIM,GCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          GIDX(25),GIMX(25),GID(25),GIM(25),
     X          GSFPFX(25),GMPSFX(25),GNPX(5,25),
     X          GSFPF(25),GMPSF(25),GNP(5,25),GCARD(25)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/G/ GIDX,GIMX,GID,GIM,
     X          GSFPFX,GMPSFX,GNPX,GSFPF,GMPSF,GNP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(G) .GT. 0)GO TO 900
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
900   K = K+1
      K1 = K-1
      IF(K .LE. 25)GO TO 905
C TOO MANY FACILITY MANPOWER INPUTS. OMIT CARD.
      READ(8,903)ICDNO
903   FORMAT(80X,I3)
      CALL ERROR(43,G,ICDNO)
      K = K-1
      GO TO 990
905   READ(8,910) GIDX(K), GIMX(K), GSFPFX(K), GMPSFX(K),
     1 (GNPX(J,K),J=1,5), GCARD(K)
910   FORMAT( 2X,2I2,F7.0,F6.0,5F5.0,36X,I3)
C*************************************************************************
      IF(GIDX(K) .GT. 0)GO TO 920
C FACILITY ID IS 0,BLANK,OR NEGATIVE.  OMIT CARD.
      CALL ERROR(18,IDUMMY,GCARD(K))
      K = K-1
      GO TO 990
C  CHECK FOR DUPLICATE FACILITY ID
920   IF(K .EQ. 1)GO TO 950
      DO 930 I=1,K1
      IF(GIDX(K) .EQ. GIDX(I))GO TO 940
930   CONTINUE
      GO TO 950
C DUPLICATE FOUND.  OMIT CARD.
940   CALL ERROR(19,GCARD(I),GCARD(K))
      K = K-1
      GO TO 990
950   IF(GIMX(K) .EQ. 1 .OR. GIMX(K) .EQ. 2)GO TO 990
C ILLEGAL VALUE FOR INPUT METHOD. MUST EQUAL 1 OR 2. OMIT CARD.
      CALL ERROR(37,IDUMMY,GCARD(K))
      K = K-1
      GO TO 990
C*************************************************************************
990   NTYPE(G) = K
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** TRAINING ADMIN.,BASE OP. SUPPORT,AND MEDICAL PERSONNEL INPUTS  ***
C*************************************************************************
      SUBROUTINE READA
      INTEGER   APT,AIM,ACARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          APT(3),AIM(3),AFMPC(3),AVMPCS(3),
     X          AVMTDY(3),ANP(6,3),ACARD(3)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/A/ APT,AIM,AFMPC,AVMPCS,AVMTDY,ANP
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(A) .GT. 0)GO TO 1000
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
1000  K = K+1
      K1 = K-1
      IF(K .LE. 3)GO TO 1005
C  MORE THAN 3 TYPE-A CARDS.  OMIT THIS CARD.
      READ(8,1003)ICDNO
1003  FORMAT(80X,I3)
      CALL ERROR(43,A,ICDNO)
      K=K-1
      GO TO 1090
1005  READ(8,1010) APT(K),AIM(K),AFMPC(K),AVMPCS(K),AVMTDY(K),
     1 (ANP(J,K),J=1,6),ACARD(K)
1010  FORMAT( 2X,2I2,3F5.0,6F5.0,29X,I3)
C*************************************************************************
      IF(APT(K) .GE. 13 .AND. APT(K) .LE. 15)GO TO 1020
C  INVALID PERSONNEL TYPE.  OMIT CARD.
      CALL ERROR(20,IDUMMY,ACARD(K))
      K = K-1
      GO TO 1090
C  CHECK FOR DUPLICATE PERSONNEL TYPE
1020  IF(K .EQ. 1)GO TO 1050
      DO 1030 I=1,K1
      IF(APT(K) .EQ. APT(I))GO TO 1040
1030  CONTINUE
      GO TO 1050
C DUPLICATE FOUND.  OMIT CARD.
1040  CALL ERROR(21,ACARD(I),ACARD(K))
      K = K-1
      GO TO 1090
1050  IF(AIM(K) .EQ. 1 .OR. AIM(K) .EQ. 2)GO TO 1090
C ILLEGAL VALUE FOR INPUT METHOD. MUST EQUAL 1 OR 2. OMIT CARD.
      CALL ERROR(38,IDUMMY,ACARD(K))
      K = K-1
      GO TO 1090
C*************************************************************************
1090  NTYPE(A) = K
      RETURN
      END
```

```
C
C
C*************************************************************************
C ***  COMPUTER SERVICE CHARGES ***
C*************************************************************************
      SUBROUTINE READB
      INTEGER   BCARD1,BCARD2,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          BSC(5)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/B/ BSC
C
      IF(NTYPE(B) .NE. 0)GO TO 1120
      READ(8,1110) (BSC(J),J=1,5),BCARD1
1110  FORMAT( 2X,5F6.0,48X,I3)
      GO TO 1190
C  MORE THAN ONE COMPUTER SERVICE CHARGES CARD. THIS CARD IGNORED
1120  READ(8,1130) BCARD2
1130  FORMAT( 80X,I3)
      CALL ERROR(22,BCARD1,BCARD2)
1190  NTYPE(B) = 1
      RETURN
      END
```

```
C
C
C*********************************************************************
C ***  OFF/AIR/CIV DISTRIBUTION OVERRIDES ***
C*********************************************************************
      SUBROUTINE READO
      INTEGER   OCARD1,OCARD2,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          OFLAG(34), A1(34), OVRRID(34)
      DATA BLANK/1H /, STAR/1H*/
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/O/ OCOFF,OCAMN,OCCIV,  OHOFF,OHAMN,OHCIV,
     X          OFOFF,OFAMN,OFCIV,  OAOFF,OAAMN,OACIV,
     X          OBOFF,OBAMN,OBCIV,  OMOFF,OMAMN,OMCIV,
C
     X          OAHMPM,OAOMPM,OATDPM,OTHPD,OMSCPM,
     X          OCPMIO,OCPMIA,OCPMIC,OCPMSO,OCPMSA,OCPMSC,
     X          OTDYTC,OTDYOF,OTDYAM,OTDYCV,DR
      COMMON/O1/ OFLAG
      EQUIVALENCE (OCOFF,OVRRID(1))
C
      IF(NTYPE(O) .NE. 0)GO TO 1320
C READ EACH FIELD OF OFF/AIR/CIV OVERRIDE CARD WITH AN A1 FORMAT
      READ(8,1305) (A1(I),I=1,18)
1305  FORMAT(2X,18(2X,A1))
C FOR EACH NON-BLANK OVERRIDE FIELD, SET FLAG=STAR
      DO 1306 I=1,18
      IF(A1(I) .NE. BLANK) OFLAG(I)=STAR
1306  CONTINUE
C BACKSPACE RECORD AND READ THE OVERRIDE VALUES
      BACKSPACE 8
      READ(8,1310)OCOFF,OCAMN,OCCIV,OHOFF,OHAMN,OHCIV,OFOFF,OFAMN,OFCIV,
     1 OAOFF,OAAMN,OACIV,OBOFF,OBAMN,OBCIV,OMOFF,OMAMN,OMCIV,  OCARD1
1310  FORMAT( 2X,18F3.0,24X,I3)
C SUM OF OFF-AIR-CIV DISTRIBUTIONS MUST=100%
      IERR = 0
      DO 1315 I=1,6
      I1 = 3*(I-1)+1
      I2 = 3*(I-1)+2
      I3 = 3*(I-1)+3
C
C IF ANY VALUE IN A SET OF 3 IS NON-BLANK, THEN INTERPRET
C              ALL 3 AS NON-BLANK
      IF(OFLAG(I1) .NE. STAR .AND. OFLAG(I2) .NE. STAR
     X                       .AND. OFLAG(I3) .NE. STAR)GO TO 1315
      OFLAG(I1) = STAR
      OFLAG(I2) = STAR
      OFLAG(I3) = STAR
      SUM = OVRRID(I1)+OVRRID(I2)+OVRRID(I3)
      IF(SUM .GT. 99.95 .AND. SUM .LT. 100.05)GO TO 1315
```

```
C
C
C SUM DOES NOT EQUAL 100%. USE TABLE VALUE.
      OFLAG(I1) = BLANK
      OFLAG(I2) = BLANK
      OFLAG(I3) = BLANK
      IF(IERR .EQ. 0)CALL ERROR(30,OCARD1,IDUMMY)
      IERR = 1
1315  CONTINUE
      GO TO 1390
C  MORE THAN ONE OFF/AIR/CIV OVERRIDE CARD.  THIS CARD IS IGNORED.
1320  READ(8,1330) OCARD2
1330  FORMAT(80X,I3)
      CALL ERROR(25,OCARD1,OCARD2)
1390  NTYPE(O) = 1
      RETURN
      END
```

```
C
C
C*********************************************************************
C ***  MISCELLANEOUS OVERRIDES ***
C*********************************************************************
      SUBROUTINE READOO
      INTEGER   OCARD1,OCARD2,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          OFLAG(34), A1(34), OVRRID(34)
      DATA BLANK/1H /, STAR/1H*/
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/O/ OCOFF,OCAMN,OCCIV,  OHOFF,OHAMN,OHCIV,
     X          OFOFF,OFAMN,OFCIV,  OAOFF,OAAMN,OACIV,
     X          OBOFF,OBAMN,OBCIV,  OMOFF,OMAMN,OMCIV,
C
     X          OAHMPM,OAOMPM,OATDPM,OTHPD,OMSCPM,
     X          OCPMIO,OCPMIA,OCPMIC,OCPMSO,OCPMSA,OCPMSC,
     X          OTDYTC,OTDYOF,OTDYAM,OTDYCV,DR
      COMMON/O1/ OFLAG
      EQUIVALENCE (OCOFF,OVRRID(1))
C
      IF(NTYPE(OO) .NE. 0)GO TO 1420
C READ EACH FIELD OF MISCELLANEOUS OVERRIDE CARD WITH AN A1 FORMAT
      READ(8,1405) (A1(I),I=19,34)
1405  FORMAT(2X,4(3X,A1),4X,A1,7(3X,A1),3(2X,A1),1X,A1)
C FOR EACH NON-BLANK OVERRIDE FIELD, SET FLAG=STAR
      DO 1406 I=19,34
      IF(A1(I) .NE. BLANK) OFLAG(I)=STAR
1406  CONTINUE
C BACKSPACE RECORD AND READ THE OVERRIDE VALUES
      BACKSPACE 8
      READ(8,1410) OAHMPM,OAOMPM,OATDPM,OTHPD,OMSCPM,OCPMIO,OCPMIA,
     X             OCPMIC,OCPMSO,OCPMSA,OCPMSC,
     X             OTDYTC,OTDYOF,OTDYAM,OTDYCV,DR,  OCARD1
1410  FORMAT( 2X,4F4.0,F5.0,7F4.0,3F3.0,F2.0,18X,I3)
      GO TO 1490
C  MORE THAN ONE MISCELLANEOUS OVERRIDE CARD.  THIS CARD IS IGNORED.
1420  READ(8,1430) OCARD2
1430  FORMAT(80X,I3)
      CALL ERROR(41,OCARD1,OCARD2)
1490  NTYPE(OO) = 1
      RETURN
      END
```

```
C
C
C*****************************************************************************
C *** PAY AND ALLOWANCE OVERRIDES ***
C*****************************************************************************
      SUBROUTINE READP
      INTEGER   PPD,PPG,PCARD,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          PPD(75),PPG(75),PPAF(75),PCARD(75)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/P/ PPD,PPG,PPAF
C
C  IF FIRST ENTRY TO SUBROUTINE,  INITIALIZE K
      IF(NTYPE(P) .GT. 0)GO TO 1200
C  (K: GETS INCREMENTED FOR EACH ERROR-FREE DATA CARD)
      K = 0
1200  K = K+1
      K1 = K-1
      IF(K .LE. 75)GO TO 1205
C TOO MANY PAY FACTOR OVERRIDE INPUTS. OMIT CARD.
      READ(8,1203)ICDNO
1203  FORMAT(80X,I3)
      CALL ERROR(43,P,ICDNO)
      K = K-1
      GO TO 1290
1205  READ(8,1210) PPD(K),PPG(K),PPAF(K),PCARD(K)
1210  FORMAT( 2X,2I2,F5.0,69X,I3)
C*****************************************************************************
      IF(PPD(K) .GE. 1 .AND. PPD(K) .LE. 5)GO TO 1215
C  ILLEGAL PERSONNEL DESIGNATOR.  OMIT CARD.
      CALL ERROR(23,IDUMMY,PCARD(K))
      K = K-1
      GO TO 1290
C CHECK FOR ILLEGAL PERSONNEL DESIGNATOR-PAY GRADE PAIR
1215  IF(PPD(K) .EQ. 1 .AND. PPG(K) .GE. 0
     1       .AND. PPG(K) .LE. 10)GO TO 1220
      IF(PPD(K) .EQ. 2 .AND. PPG(K) .GE. 0
     1       .AND. PPG(K) .LE. 9)GO TO 1220
      IF(PPD(K) .EQ. 3 .AND. PPG(K) .GE. 0
     1       .AND. PPG(K) .LE. 18)GO TO 1220
      IF(PPD(K) .EQ. 4 .AND. PPG(K) .GE. 0
     1       .AND. PPG(K) .LE. 14)GO TO 1220
      IF(PPD(K) .EQ. 5 .AND. PPG(K) .GE. 0
     1       .AND. PPG(K) .LE. 20)GO TO 1220
C ILLEGAL PAIR FOUND
      CALL ERROR(28,IDUMMY,PCARD(K))
      K = K-1
      GO TO 1290
```

```
C
C
C  CHECK FOR DUPLICATE PERSONNEL DESIGNATOR-PAY GRADE
1220  IF(K .EQ. 1)GO TO 1290
      DO 1230 I=1,K1
      IF(PPD(K) .EQ. PPD(I) .AND. PPG(K) .EQ. PPG(I))GO TO 1240
1230  CONTINUE
      GO TO 1290
C DUPLICATE FOUND.  OMIT CARD.
1240  CALL ERROR(24,PCARD(I),PCARD(K))
      K = K-1
      GO TO 1290
C*************************************************************************
1290  NTYPE(P) = K
      RETURN
      END
```

```
C
C
C*********************************************************************
C***  PRINT PROGRAM CONSTANTS AND OVERRIDES  ***
C*********************************************************************
C
      SUBROUTINE PRINT1(QCONST,OFLAG)
      DIMENSION  QCONST(34), OFLAG(34)
      DATA STAR/1H*/
C
      CALL HEAD
C
      WRITE(6,6010)
6010  FORMAT( 1H0,42X,25H    PROGRAM CONSTANTS     ,10X,
     1 40H* INDICATES USER OVERRIDE VALUE (IF ANY),
     1 /47X,8(2H==), 1H=/1X/
     2        28X, 42H   OFFICER/AIRMAN/CIVILIAN DISTRIBUTION    /,
     4        36X, 10HCURRICULUM     )
C
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=1,3)
6020  FORMAT( 40X, 3HOFF, 37X, F4.0, 1X, A1 /
     1        40X, 3HAMN, 37X, F4.0, 1X, A1 /
     2        40X, 3HCIV, 37X, F4.0, 1X, A1  )
C
      WRITE(6,6030)
6030  FORMAT(1H0, 35X, 8HHARDWARE    )
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=4,6)
C
      WRITE(6,6040)
6040  FORMAT(1H0, 35X, 8HFACILITY    )
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=7,9)
C
      WRITE(6,6050)
6050  FORMAT(1H0, 35X, 23HTRAINING ADMINISTRATIVE    )
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=10,12)
C
      WRITE(6,6060)
6060  FORMAT(1H0, 35X, 15HBASE OPERATIONS    )
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=13,15)
C
      WRITE(6,6070)
6070  FORMAT(1H0, 35X, 7HMEDICAL    )
      WRITE(6,6020) (QCONST(I),  OFLAG(I), I=16,18)
C
      WRITE(6,6080) (QCONST(I),  OFLAG(I), I=19,23),
     X (QCONST(J),OFLAG(J),QCONST(J+3),OFLAG(J+3),J=24,26)
      WRITE(6,6085)
     X (QCONST(K),OFLAG(K),K=30,34)
```

```
C
C
6080  FORMAT( 1HO, 27X, 42H   AVAILABLE PRODUCTIVE MAN-HOURS/MONTH    /
     1        34X, 14H  HARDWARE MTC, 31X, F5.0, 1X, A1 /
     2        34X, 12H  ALL OTHERS,   33X, F5.0, 1X, A1 /1X/
     3        28X, 33H   AVERAGE TRAINING DAYS/MONTH    ,18X, F6.1,
     4         1X, A1 / 1X /
     5        28X, 45H   AVERAGE CLASSROOM TRAINING HRS/STUDENT/DAY,
     6         6X, F5.0, 1X, A1 / 1X /
     7        28X,36H   MISC. SUPPLY COST/MAN-YEAR ($)   ,15X,
     8         F6.0, 1X, A1 / 1X /
     9        28X, 23H   PCS COST/MOVE ($)    /
    X 40X, 8HINST OFF, 31X, F5.0, 1X, A1,2X,7HSTD OFF,10X,F5.0,1X,A1 /
    X 40X, 8HINST AMN, 31X, F5.0, 1X, A1,2X,7HSTD AMN,10X,F5.0,1X,A1 /
    X 40X,8HINST CIV,31X,F5.0,1X,A1,2X,7HSTD CIV,10X,F5.0,1X,A1 /,1X)
 6085 FORMAT(1HO,
    X        27X, 17H   TDY EXPENSE    /
    X        36X, 32HAVG. ROUND TRIP TRANSP. COST ($) ,
    X        11X, F5.0, 1X, A1 /
    X        36X, 20HDESTINATION PER DIEM /
    X        40X, 3HOFF, 37X, F4.0, 1X, A1 /
    X        40X, 3HAMN, 37X, F4.0, 1X, A1 /
    X        40X, 3HCIV, 37X, F4.0, 1X, A1  /
    X 31X,'DISCOUNT RATE (%)',33X,F5.2,1X,A1 )
     RETURN
     END
```

```
C
C
C*************************************************************************
C *** PRINT PAY FACTOR TABLES AND OVERRIDES ***
C*************************************************************************
C
      SUBROUTINE PRINT2( PAY, PAYAV, XPFLG, XAVFLG)
      DIMENSION PAY(20,5), PAYAV(5), XPFLG(20,5), XAVFLG(5)
C
      CALL HEAD
C
      WRITE(6,5010)
5010  FORMAT( 1H0, 38X, 34H    ANNUAL PAY RATES (FY 1975)     /
     1        43X, 13(2H==) / 1X / 1X /
     2         9X, 22H  MILITARY PERSONNEL  ,
     3        13X, 22H  CIVILIAN PERSONNEL  ,
     4        14X, 20H  FOREIGN STUDENTS   /
     5         1X /
     6        13X,  3HPAY, 4X, 6HANNUAL, 22X, 3HPAY, 5X, 6HANNUAL,
     7        22X,  3HPAY, 4X, 6HANNUAL, /
     8        12X,  5HGRADE, 4X, 4HRATE, 22X, 5HGRADE, 5X, 4HRATE,
     9        22X,  5HGRADE, 4X, 4HRATE, /
     X        12X,  5H-----, 3X, 6H------, 21X, 5H-----, 4X, 6H------,
     X        21X,  5H-----, 3X, 6H------  )
C
      WRITE(6,5015) PAY(1,1), XPFLG(1,1), PAY(1,3), XPFLG(1,3),
     1              PAY(1,5), XPFLG(1,5)
5015  FORMAT( 12X, 8HO- 1   $,  F6.0, 1X, A1,
     1        19X, 9HGS- 1   $, F6.0, 1X, A1,
     2        19X, 8HF- 1   $,  F6.0, 1X, A1  )
C
      WRITE(6,5020) (I, PAY(I,1), XPFLG(I,1),
     1               I, PAY(I,3), XPFLG(I,3),
     2               I, PAY(I,5), XPFLG(I,5), I=2,10)
5020  FORMAT(12X, 2HO-,  I2, 4X, F6.0, 1X, A1,
     1       19X, 3HGS-, I2, 4X, F6.0, 1X, A1,
     2       19X, 2HF-,  I2, 4X, F6.0, 1X, A1   )
C
      WRITE(6,5030)    PAYAV(1), XAVFLG(1),
     1             (I, PAY(I,3), XPFLG(I,3),
     2              I, PAY(I,5), XPFLG(I,5), I=11,13  )
5030  FORMAT(12X, 6HO-AVG., 2X, F6.0, 1X, A1,
     1       19X, 3HGS-,I2, 4X, F6.0, 1X, A1,
     2       19X, 2HF-, I2, 4X, F6.0, 1X, A1 /
     3       47X, 3HGS-, I2, 4X, F6.0, 1X, A1,
     4       19X, 2HF-,  I2, 4X, F6.0, 1X, A1 /
     5       47X, 3HGS-, I2, 4X, F6.0, 1X, A1,
     6       19X, 2HF-,  I2, 4X, F6.0, 1X, A1  )
C
      DO 5040 I=1,5
      I13 = I+13
      WRITE(6,5050)    I, PAY(I,2), XPFLG(I,2),
     1                I13, PAY(I13,3), XPFLG(I13,3),
     2                I13, PAY(I13,5), XPFLG(I13,5)
5040  CONTINUE
```

```
C
C
5050  FORMAT(12X, 2HE-,  I2, 4X, F6.0, 1X, A1,
     1       19X, 3HGS-, I2, 4X, F6.0, 1X, A1,
     2       19X, 2HF-,  I2, 4X, F6.0, 1X, A1  )
C
      WRITE(6,5060)  PAY(6,2),  XPFLG(6,2),
     1               PAYAV(3),  XAVFLG(3),
     2               PAY(19,5), XPFLG(19,5),
     3               PAY(7,2),  XPFLG(7,2),
     4               PAY(20,5), XPFLG(20,5),
     5               PAY(8,2),  XPFLG(8,2),
     6               PAYAV(5),  XAVFLG(5),
     7               PAY(9,2),  XPFLG(9,2),
     8               PAY(1,4),  XPFLG(1,4),
     9               PAYAV(2),  XAVFLG(2),
     X               PAY(2,4),  XPFLG(2,4)
5060  FORMAT(12X, 4HE- 6,    4X, F6.0, 1X, A1,
     1       19X, 7HGS-AVG., 2X, F6.0, 1X, A1,
     2       19X, 4HF-19,    4X, F6.0, 1X, A1  /
     3       12X, 4HE- 7,    4X, F6.0, 1X, A1,
     4       55X, 4HF-20,    4X, F6.0, 1X, A1  /
     5       12X, 4HE- 8,    4X, F6.0, 1X, A1,
     6       55X, 6HF-AVG.,  2X, F6.0, 1X, A1  /
     7       12X, 4HE- 9,    4X, F6.0, 1X, A1,
     8       19X, 5HWB- 1,   4X, F6.0, 1X, A1  /
     9       12X, 6HE-AVG.,  2X, F6.0, 1X, A1,
     X       19X, 5HWB- 2,   4X, F6.0, 1X, A1    )
C
      WRITE(6,5070) (I, PAY(I,4), XPFLG(I,4), I=3,14)
5070  FORMAT( 47X, 3HWB-, I2, 4X, F6.0, 1X, A1 )
C
      WRITE(6,5080) PAYAV(4), XAVFLG(4)
5080  FORMAT( 47X, 7HWB-AVG., 2X, F6.0, 1X, A1 )
C
      WRITE(6,5090)
5090  FORMAT( 5(1X/), 3X, 40H* INDICATES USER OVERRIDE VALUE (IF ANY))
C
      RETURN
      END
```

```
C
C
C ***************************************************************
C *** SPHASE -- TIME PHASED GRADUATE MAN-YEAR CALCULATIONS ***
C ***************************************************************
C
      SUBROUTINE SPHASE
C
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          ST,SPD,SPG,SIM
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39)
      DIMENSION ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75)
      DIMENSION GRATE(7),FRATE(7),GRADS(7,7),WASH(7,7),COMPLT(7),FAIL(7)
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
C
C  A12=NO. HRS. IN 12 MOS.
C  A24=NO. HRS. IN 24 MOS.
      A12=(12.*QATDPM)*QTHPD
      A24=(24.*QATDPM)*QTHPD
      IF(DGCD.GT.A12)GO TO 2000

C***************************************************************************
C
C COURSE DURATION < = 12 MONTHS
C
           NS = NTYPE(S)
           DO 1000 K=1,NS
C          ==============
C
      CALL INITF(GRATE,7)
      CALL INITF(FRATE,7)
      CALL INITF(GRADS,49)
      CALL INITF(WASH,49)
C
C GRAD. RATE, FAIL. RATE, FOR STUDENTS ENTERING IN YEAR I (PER MO.)
C
      DO 10 I=1,5
      COMPLT(I) = ROUND0(SENTS(I,K)*(1.-DWR/100.))
      FAIL(I) = SENTS(I,K)-COMPLT(I)
      GRATE(I)=COMPLT(I)/(A12/DEI)
      FRATE(I)=SENTS(I,K)/(A12/DEI)-GRATE(I)
10    CONTINUE
```

```
C
C
C NO. OF YEAR I ENTRANTS GRADUATING IN YEAR J(J=I,I+1)
C
      DO 20 I=1,5
      I1=I+1
      DO 20 J=I,I1
      IF(J.EQ.I) GRADS(I,J)=ROUNDO(GRATE(I) *AINT(A12/DEI+1.-DGCD/DEI))
      IF(J.EQ.I+1) GRADS(I,J)=COMPLT(I) - GRADS(I,I)
20    CONTINUE
C
C TOTAL NO. GRADUATES IN YEAR I
C
      IF(SIM(K) .EQ. 2)GO TO 35
      DO 30 I=1,6
      IF(I.EQ.1) SNGRAD(I,K)=ROUNDO(GRADS(I,I))
      IF(I.GT.1) SNGRAD(I,K)=ROUNDO(GRADS(I,I) + GRADS(I-1,I))
30    CONTINUE
C
C NO. OF YEAR I ENTRANTS WASHING OUT IN YEAR J(J=I,I+1)
C
35    CONTINUE
      DO 40 I=1,5
      I1=I+1
      DO 40 J=I,I1
      IF(J.EQ.I) WASH(I,J)=ROUNDO(FRATE(I)*AINT(A12/DEI+1.-DWCD/DEI))
      IF(J.EQ.I+1) WASH(I,J)=FAIL(I) - WASH(I,I)
40    CONTINUE
C
C TOTAL NO. WASHOUTS IN YEAR I
C
      DO 45 I=1,6
      IF(I.EQ.1)SNWASH(I,K)=ROUNDO(WASH(I,I))
      IF(I.GT.1)SNWASH(I,K)=ROUNDO(WASH(I-1,I)+WASH(I,I))
45    CONTINUE
C
C
      DO 50 I=1,6
C MAN-YEARS FOR YEAR I ENTRANTS GRADUATING IN YEAR I
      IF(I.LE.5) EIGI=GRADS(I,I) * DGCD/A12
      IF(I.EQ.6) EIGI=0.
C MAN-YEARS FOR YEAR I ENTRANTS GRADUATING IN YEAR I+1
      IF(I.LE.5) EIGIP1=GRADS(I,I+1) * DGCD/A24
      IF(I.EQ.6) EIGIP1=0.
C MAN-YEARS FOR YEAR I-1 ENTRANTS GRADUATING IN YEAR I
      IF(I.EQ.1) EIM1GI=0.
      IF(I.GT.1) EIM1GI=GRADS(I-1,I) * DGCD/A24
C MAN-YEARS FOR YEAR I ENTRANTS WASHING OUT IN YEAR I
      EIWI=WASH(I,I) * DWCD/A12
C MAN-YEARS FOR YEAR I ENTRANTS WASHING OUT IN YEAR I+1
      EIWIP1=WASH(I,I+1) * DWCD/A24
C MAN-YEARS FOR YEAR I-1 ENTRANTS WASHING OUT IN YEAR I
      IF(I.EQ.1) EIM1WI=0.
      IF(I.GT.1) EIM1WI=WASH(I-1,I) * DWCD/A24
C TOTAL MAN-YEARS IN YEAR I (GRADUATES + WASHOUTS)
      IF(SIM(K).EQ.1)SMYRS(I,K)=EIGI+EIGIP1+EIM1GI+EIWI+EIWIP1+EIM1WI
50    CONTINUE
C
1000  CONTINUE
      RETURN
```

```
C
C
C*****************************************************************
C
C
C     12 < COURSE DURATION <= 24 MONTHS
C
2000  CONTINUE
C
            NS = NTYPE(S)
            DO 3000 K=1,NS
C           ==============
C
      CALL INITF(GRATE,7)
      CALL INITF(FRATE,7)
      CALL INITF(GRADS,49)
      CALL INITF(WASH,49)
C
C GRAD. RATE, FAIL. RATE, FOR STUDENTS ENTERING IN YEAR I (PER MO.)
C
      DO 2010 I=1,5
      COMPLT(I) = ROUNDO(SENTS(I,K)*(1.-DWR/100.))
      FAIL(I) = SENTS(I,K)-COMPLT(I)
      GRATE(I)=COMPLT(I)/(A12/DEI)
      FRATE(I)=SENTS(I,K)/(A12/DEI) - GRATE(I)
2010  CONTINUE
C
C NO. OF YEAR I ENTRANTS GRADUATING IN YEAR J(J=I+1,I+2)
C
      DO 2020 I=1,5
      I1=I+1
      I2=I+2
      DO 2020 J=I1,I2
      IF(J.EQ.I+1)GRADS(I,J)=ROUNDO(GRATE(I)*AINT(A24/DEI+1.-DGCD/DEI))
      IF(J.EQ.I+2) GRADS(I,J)=COMPLT(I) - GRADS(I,J-1)
2020  CONTINUE
C
C TOTAL NO. GRADUATES IN YEAR I
C
      IF(SIM(K) .EQ. 2)GO TO 2035
      DO 2030 I=1,7
      IF(I.EQ.1) SNGRAD(I,K)=0.
      IF(I.EQ.2) SNGRAD(I,K)=ROUNDO(GRADS(I-1,I))
      IF(I.GT.2.AND.I.LT.7)SNGRAD(I,K)=ROUNDO(GRADS(I-1,I)+GRADS(I-2,I))
C LUMP YEARS 6 AND 7 TOGETHER
      IF(I.EQ.7)SNGRAD(I-1,K)=ROUNDO(SNGRAD(I-1,K)+GRADS(I-2,I))
2030  CONTINUE
C
C NO. OF YEAR I ENTRANTS WASHING OUT IN YEAR J(J=I,I+1)
C
2035  CONTINUE
      DO 2040 I=1,5
      I1=I+1
      DO 2040 J=I,I1
      IF(J.EQ.I) WASH(I,J)=ROUNDO(FRATE(I)*AINT(A12/DEI+1.-DWCD/DEI))
      IF(J.EQ.I+1) WASH(I,J)=FAIL(I) - WASH(I,J-1)
2040  CONTINUE
```

```
C
C
C TOTAL NO. WASHOUTS IN YEAR I
C
      DO 2043 I=1,6
      IF(I.EQ.1)SNWASH(I,K)=ROUNDO(WASH(I,I))
      IF(I.GE.2)SNWASH(I,K)=ROUNDO(WASH(I-1,I)+WASH(I,I))
2043  CONTINUE
C
C
      DO 2050 I=1,7
C MAN-YEARS FOR YEAR I ENTRANTS WHO WILL SUCCESSFULLY COMPLETE COURSE
      IF(I.LE.5) EI=0.542*(SENTS(I,K)-WASH(I,I)-WASH(I,I+1))
      IF(I.GT.5) EI=0.
C MAN-YEARS FOR YEAR I-1 ENTRANTS GRADUATING IN YEAR I
      IF(I.EQ.1.OR.I.EQ.7) EIM1GI=0.
      IF(I.NE.1.AND.I.NE.7) EIM1GI=GRADS(I-1,I) * DGCD/A24
C MAN-YEARS FOR YEAR I-1 ENTRANTS GRADUATING IN YEAR I+1
      IF(I.EQ.1.OR.I.EQ.7) EM1GP1=0.
      IF(I.NE.1.AND.I.NE.7) EM1GP1=GRADS(I-1,I+1)
C MAN-YEARS FOR YEAR I-2 ENTRANTS GRADUATING IN YEAR I
      IF(I.EQ.1.OR.I.EQ.2) EIM2GI=0.
      IF(I.GT.2) EIM2GI=GRADS(I-2,I) * (DGCD-A12)/A24
C MAN-YEARS FOR YEAR I ENTRANTS WASHING OUT IN YEAR I
      EIWI=WASH(I,I) * DWCD/A12
C MAN-YEARS FOR YEAR I ENTRANTS WASHING OUT IN YEAR I+1
      IF(I.LE.5)EIWIP1=WASH(I,I+1) * DWCD/A24
      IF(I.GT.5)EIWIP1=0.
C MAN-YEARS FOR YEAR I-1 ENTRANTS WASHING OUT IN YEAR I
      IF(I.EQ.1) EIM1WI=0.
      IF(I.GT.1) EIM1WI=WASH(I-1,I) * DWCD/A24
C TOTAL MAN-YEARS IN YEAR I (GRADUATES + WASHOUTS)
C LUMP YEARS 6 AND 7 TOGETHER
      IF(SIM(K).EQ.2)GO TO 2045
      SUM=EI+EIM1GI+EM1GP1+EIM2GI + EIWI+EIWIP1+EIM1WI
      IF(I.LT.7) SMYRS(I,K)=SUM
      IF(I.EQ.7) SMYRS(I-1,K)=SMYRS(I-1,K) + SUM
2045  CONTINUE
2050  CONTINUE
C
3000  CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C     OUTPUT 1 -- GRADUATE SUMMARY
C*************************************************************************
C
      SUBROUTINE OUT1
      INTEGER   ST,SPD,SPG,SIM,
     X          U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20),NTYPE(20),TITLE(39),
     X          ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
     X          V1(13,8)
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/V1/ V1
C
      CALL INITF(V1,104)
      N = NTYPE(S)
      IF(N .EQ. 0)GO TO 10700
C
10000 CONTINUE
      DO 10200 I=1,N
      IST = ST(I)
      IPD = SPD(I)
C ACTIVE DUTY FORCE
      IF((IST .EQ. 1 .OR. IST .EQ. 2) .AND. (IPD .EQ. 1))
     X         IROW=1
      IF((IST .EQ. 1 .OR. IST .EQ. 2) .AND. (IPD .EQ. 2))
     X         IROW=2
      IF((IST .EQ. 1 .OR. IST .EQ. 2).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X         IROW=3
C GUARD AND RESERVE
      IF((IST .EQ. 3 .OR. IST .EQ. 4) .AND. (IPD .EQ. 1))
     X         IROW=4
      IF((IST .EQ. 3 .OR. IST .EQ. 4) .AND. (IPD .EQ. 2))
     X         IROW=5
      IF((IST .EQ. 3 .OR. IST .EQ. 4).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X         IROW=6
C OTHER DOD
      IF((IST .EQ. 5 .OR. IST .EQ. 6) .AND. (IPD .EQ. 1))
     X         IROW=7
      IF((IST .EQ. 5 .OR. IST .EQ. 6) .AND. (IPD .EQ. 2))
     X         IROW=8
      IF((IST .EQ. 5 .OR. IST .EQ. 6).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X         IROW=9
C NON-DOD
      IF(IST .EQ. 7)
     X         IROW=10
```

```
C
C
C ADD 'NO. GRADS.' INTO ITS SLOT IN GRADS X YEAR MATRIX
      DO 10100 J=1,5
      V1(IROW,J) = V1(IROW,J) + SNGRAD(J,I)
10100 CONTINUE
C  (COL. 7 = "IN PROGRESS" = YEAR 6)
      V1(IROW,7) = V1(IROW,7) + SNGRAD(6,I)
10200 CONTINUE
C
C ROUND TO INTEGER VALUES
      DO 10250 I=1,10
      DO 10250 J=1,7
      V1(I,J) = ROUND0(V1(I,J))
10250 CONTINUE
C
C CALCULATE TOTAL GRADUATES FOR YEARS 1-5
      DO 10300 J=1,5
      DO 10300 I=1,10
      V1(11,J) = V1(11,J) + V1(I,J)
10300 CONTINUE
C
C CALCULATE TOTAL ENTRANTS, TOTAL WASHOUTS, FOR YEARS 1-5
      DO 10310 I=1,N
      DO 10310 J=1,5
      V1(12,J) = V1(12,J) + SENTS(J,I)
      V1(13,J) = V1(13,J) + SNWASH(J,I)
10310 CONTINUE
C
C CALCULATE SUBTOTALS
      DO 10400 I=1,13
      DO 10400 J=1,5
      V1(I,6) = V1(I,6) + V1(I,J)
10400 CONTINUE
C
C
C  CALCULATE TOTAL GRADS. "IN PROGRESS" (=COL 7)
      DO 10410 I=1,10
      V1(11,7) = V1(11,7) + V1(I,7)
10410 CONTINUE
C
C  CALCULATE TOTAL ENTRANTS, TOTAL WASHOUTS, "IN PROGRESS" (COL 7)
      DO 10420 I=1,N
      V1(12,7) = V1(12,7) + SENTS(6,I)
      V1(13,7) = V1(13,7) + SNWASH(6,I)
10420 CONTINUE
C
C  CALCULATE "TOTAL" COLUMN (COL 8)
      DO 10430 I=1,13
      V1(I,8) = V1(I,6) + V1(I,7)
10430 CONTINUE
C
10650 CONTINUE
```

```
C
C
C *** PRINT ***
C
10700 CALL HEAD
C
      WRITE(6,11000)
11000 FORMAT( 1H0, 46X, 16HGRADUATE SUMMARY /47X, 8(2H==) /1X/1X)
C
      WRITE(6,11100) DGCD, DWR, DWCD, DEI
11100 FORMAT( 30X, 39HAVERAGE COURSE DURATION FOR GRADUATES =,
     1        F6.1, 7H HOURS  / 1X /
     2        30X, 14HWASHOUT RATE =, F6.1,  1H% / 1X /
     3        30X, 38HAVERAGE COURSE DURATION FOR WASHOUTS =,
     4        F6.1,  7H HOURS  / 1X /
     5        30X, 24HSTUDENT ENTRY INTERVAL =,
     6        F6.1, 7H HOURS / 1X / 1X / 1X  )
C
      WRITE(6,11200)
11200 FORMAT( 15X, 13HGRADUATE TYPE, 47X,
     1             27HNUMBER OF GRADUATES BY YEAR /
     2        15X, 6(2H--),1H-, 47X, 13(2H--),1H- /
     3        57X,  1H1, 6X, 1H2, 6X, 1H3, 6X, 1H4, 6X, 1H5,
     4         5X, 8HSUBTOTAL, 3X, 11HIN PROGRESS, 3X, 5HTOTAL  )
C
      WRITE(6,11300)((V1(I,J),J=1,8),I=1,11),(V1(12,J),J=1,6),V1(12,8),
     X               (V1(13,J),J=1,8)
11300 FORMAT( 15X, 18HACTIVE DUTY FORCES,
     X        22X,5(5H=====,2X),1X,4(2H==),3X,5(2H==),1H=,3X,5H=====/
     1        17X,  8HOFFICERS, 28X,  5F7.0, F9.0, F13.0, F11.0  /
     2        17X,  6HAIRMEN,   30X,  5F7.0, F9.0, F13.0, F11.0  /
     3        17X,  9HCIVILIANS,27X,  5F7.0, F9.0, F13.0, F11.0  /
     4        15X, 24HGUARD AND RESERVE FORCES     /
     5        17X,  8HOFFICERS, 28X,  5F7.0, F9.0, F13.0, F11.0  /
     6        17X,  6HAIRMEN,   30X,  5F7.0, F9.0, F13.0, F11.0  /
     7        17X,  9HCIVILIANS,27X,  5F7.0, F9.0, F13.0, F11.0  /
     8        15X, 21HOTHER DOD (ARMY,NAVY)        /
     9        17X,  8HOFFICERS, 28X,  5F7.0, F9.0, F13.0, F11.0  /
     X        17X,  6HAIRMEN,   30X,  5F7.0, F9.0, F13.0, F11.0  /
     X        17X,  9HCIVILIANS,27X,  5F7.0, F9.0, F13.0, F11.0  /
     X        15X, 13HNON-DOD (MAP), 25X, 5F7.0, F9.0, F13.0, F11.0  /
     X        54X, 5(7H------ ), 2X, 3(2H--), 7X, 3(2H--), 5X, 3(2H--)/
     X        15X, 15HTOTAL GRADUATES, 23X,5F7.0,F9.0,F13.0,F11.0 / 1X /
     X        15X,14HTOTAL ENTRANTS, 24X,5F7.0,F9.0,13X,F11.0   /1X/
     X        15X, 14HTOTAL WASHOUTS, 24X,5F7.0,F9.0,F13.0,F11.0       )
      WRITE(6,11400)
11400 FORMAT(7(1H0/), ' NOTE: BECAUSE OF STUDENT PHASING,'
     X  ' TOTAL WASHOUTS + TOTAL GRADUATES',
     X  ' MAY NOT EQUAL TOTAL ENTRANTS IN ANY GIVEN YEAR.'  )
      RETURN
      END
```

```
C
C
C*************************************************************************
C     OUTPUT 2 -- MANPOWER SUMMARY
C*************************************************************************
C
      SUBROUTINE OUT2
C
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          ST,SPD,SPG,SIM,
     X          TT,TPD,TPG,
     X          CID,CC,
     X          RIDX,RIMX,RID,RIM,
     X          HID,HC,HOD,
     X          EIDX,EIMX,EID,EIM,
     X          FID,
     X          GIDX,GIMX,GID,GIM,
     X          APT,AIM
C*************************************************************************
C
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X         V2(27,7),PCSB(6),TDYB(6),PCSM(6),TDYM(6),TNMIL(6),OMIL(6)
C
      DIMENSION ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
C
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),
C
     X          CID(75),CC(75),CTYPE(11,75),CCOPY(2,75),CMEAS(3,75),
     X          CNURQ(5,75),CNMU(75),CIPCM(75),CCCM(75),
     X          CPCC(75),CARV(75),CARP(75),
C
     X          RIDX(75),RIMX(75),RID(75),RIM(75),
     X          RNCHX(75),RMPCHX(75),RIPAX(75),RNPX(6,75),
     X          RNCH(75),RMPCH(75),RIPA(75),RNP(6,75),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75)
C
      DIMENSION EIDX(75),EIMX(75),EID(75),EIM(75),
     X          EDURX(5,75),EFRPHX(75),EAVRTX(75),ENPX(5,75),
     X          EDUR(5,75),EFRPH(75),EAVRT(75),ENP(5,75),
C
     X          FID(25),FTYPE(15,25),FCCPU(25),FNURQ(5,25),RVP(25),
C
     X          GIDX(25),GIMX(25),GID(25),GIM(25),
     X          GSFPFX(25),GMPSFX(25),GNPX(5,25),
     X          GSFPF(25),GMPSF(25),GNP(5,25),
C
     X          APT(3),AIM(3),AFMPC(3),AVMPCS(3),
     X          AVMTDY(3),ANP(6,3)
C
```

```
C
C
C*****************************************************************
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
      COMMON/C/ CID,CC,CTYPE,CCOPY,CMEAS,CNURQ,CNMU,CIPCM,
     X          CCCM,CPCC,CARV,CARP
      COMMON/R/ RIDX,RIMX,RID,RIM,
     X          RNCHX,RMPCHX,RIPAX,RNPX,RNCH,RMPCH,RIPA,RNP
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
      COMMON/E/ EIDX,EIMX,EID,EIM,
     X          EDURX,EFRPHX,EAVRTX,ENPX,EDUR,EFRPH,EAVRT,ENP
      COMMON/F/ FID,FTYPE,FCCPU,FNURQ,RVP
      COMMON/G/ GIDX,GIMX,GID,GIM,
     X          GSFPFX,GMPSFX,GNPX,GSFPF,GMPSF,GNP
      COMMON/A/ APT,AIM,AFMPC,AVMPCS,AVMTDY,ANP
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
      COMMON/V2/ V2
C*****************************************************************
C
C
      CALL INITF(V2,189)
C
C     ** STUDENTS **
      NS = NTYPE(S)
      IF(NS .EQ. 0)GO TO 11000
C
10000 CONTINUE
      DO 10200 I=1,NS
      IST = ST(I)
      IPD = SPD(I)
C ACTIVE DUTY FORCE
      IF((IST .EQ. 1 .OR. IST .EQ. 2) .AND. (IPD .EQ. 1))
     X        IROW=1
      IF((IST .EQ. 1 .OR. IST .EQ. 2) .AND. (IPD .EQ. 2))
     X        IROW=2
      IF((IST .EQ. 1 .OR. IST .EQ. 2).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X        IROW=3
C GUARD AND RESERVE
      IF((IST .EQ. 3 .OR. IST .EQ. 4) .AND. (IPD .EQ. 1))
     X        IROW=4
      IF((IST .EQ. 3 .OR. IST .EQ. 4) .AND. (IPD .EQ. 2))
     X        IROW=5
      IF((IST .EQ. 3 .OR. IST .EQ. 4).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X        IROW=6
```

```
C
C
C OTHER DOD
      IF((IST .EQ. 5 .OR. IST .EQ. 6) .AND. (IPD .EQ. 1))
     X        IROW=7
      IF((IST .EQ. 5 .OR. IST .EQ. 6) .AND. (IPD .EQ. 2))
     X        IROW=8
      IF((IST .EQ. 5 .OR. IST .EQ. 6).AND.(IPD .EQ. 3 .OR. IPD .EQ. 4))
     X        IROW=9
C NON-DOD
      IF(IST .EQ. 7)
     X        IROW=10
C
C ADD MAN-YEARS INTO ITS SLOT IN OUTPUT MATRIX
      DO 10100 J=1,5
      J1 = J+1
      V2(IROW,J1) = V2(IROW,J1) + SMYRS(J,I)
10100 CONTINUE
10200 CONTINUE
C
C ROUND TO 1 DECIMAL PLACE
      DO 10250 I=1,10
      DO 10250 J=2,6
      V2(I,J) = ROUND1(V2(I,J))
10250 CONTINUE
C
C CALCULATE COLUMN TOTALS
      DO 10300 J=1,6
      DO 10300 I=1,10
      V2(11,J) = V2(11,J) + V2(I,J)
10300 CONTINUE
C
C *** BASE PERMANENT PARTY ***
C
C    ** INSTRUCTORS **
C
11000 NT=NTYPE(T)
      IF(NT .EQ. 0)GO TO 11250
      DO 11200 I=1,NT
      ITT = TT(I)
      IPD = TPD(I)
C
C        *AIR FORCE*
      IF(ITT .EQ. 8)IROW=12
C
C        *OTHER DOD*
      IF(ITT .EQ. 9)IROW=13
C
C ADD INSTRUCTOR MAN-YEARS INTO MATRIX
      DO 11100 J=1,6
      V2(IROW,J) = V2(IROW,J) + TN(J,I)
11100 CONTINUE
11200 CONTINUE
C
C    ** CURRICULUM PERSONNEL **
C
11250 NC=NTYPE(C)
      IF(NC .EQ. 0)GO TO 12200
      DO 11600 I=1,NC
      IM = RIM(I)
```

```
C
C
C IF IM=0, THERE WAS NO CURRICULUM MANPOWER INPUT CORRESPONDING
C          TO THE I-TH COURSEWARE PROCUREMENT ID
C
      IF(IM .EQ. 0)GO TO 11600
      IF(IM .EQ. 2)GO TO 11400
C
C METHOD 1 -- CALCULATION
C   YEAR 0
C
      TERM = (RNCH(I)*RMPCH(I)*(1.-RIPA(I)/100.)) / (QAOMPM*12.)
      V2(14,1) = V2(14,1) + TERM
C   YEARS 1-5
C
      DO 11300 J=2,6
      V2(14,J) = V2(14,J) + TERM* 0.5*CARV(I)/100.
11300 CONTINUE
      GO TO 11600
C
C METHOD 2 -- THRUPUT
11400 DO 11500 J=1,6
      V2(14,J) = V2(14,J) + RNP(J,I)
11500 CONTINUE
11600 CONTINUE
C
C    ** HARDWARE MTC PERSONNEL **
C
12200 NH=NTYPE(H)
      IF(NH .EQ. 0)GO TO 13200
      DO 12600 I=1,NH
      IM = EIM(I)
C
C IF IM=0, THERE WAS NO HARDWARE MANPOWER INPUT CORRESPONDING
C          TO THE I-TH HARDWARE PROCUREMENT ID
C
      IF(IM .EQ. 0)GO TO 12600
      IF(IM .EQ. 2)GO TO 12400
C
C METHOD 1 -- CALCULATION
      DO 12300 J=1,5
      J1= J+1
      V2(15,J1) = V2(15,J1) + (EDUR(J,I)*QATDPM*EFRPH(I)*EAVRT(I)*
     1                         HNURQ(J,I)) / QAHMPM
12300 CONTINUE
      GO TO 12600
C
C METHOD 2 -- THRUPUT
12400 DO 12500 J=1,5
      J1= J+1
      V2(15,J1) = V2(15,J1) + ENP(J,I)
12500 CONTINUE
12600 CONTINUE
```

```
C
C
C
C    ** FACILITIES MTC PERSONNEL **
C
13200 NF=NTYPE(F)
      IF(NF .EQ. 0)GO TO 13605
      DO 13600 I=1,NF
      IM = GIM(I)
C
C IF IM=0, THERE WAS NO FACILITIES MANPOWER INPUT CORRESPONDING
C          TO THE I-TH FACILITIES PROCUREMENT ID
C
      IF(IM .EQ. 0)GO TO 13600
      IF(IM .EQ. 2)GO TO 13400
C
C METHOD 1 -- CALCULATION
      DO 13300 J=1,5
      J1= J+1
      V2(16,J1) = V2(16,J1) + (GMPSF(I)*GSFPF(I)*FNURQ(J,I)) / QAOMPM
13300 CONTINUE
      GO TO 13600
C
C METHOD 2 -- THRUPUT
13400 DO 13500 J=1,5
      J1= J+1
      V2(16,J1) = V2(16,J1) + GNP(J,I)
13500 CONTINUE
13600 CONTINUE
C
C
C*********************************************************************
C        TYPE A , TYPE B  CALCULATIONS
C
13605 CALL INITF(PCSB,6)
      CALL INITF(TDYB,6)
      CALL INITF(PCSM,6)
      CALL INITF(TDYM,6)
      IF(NS .EQ. 0)GO TO 13750
      IF(IFLAG .EQ. 1) GO TO 13660
C
C TYPE B (TDY).  IFLAG=0
      DO 13650 I=1,NS
      IPD = SPD(I)
      IST = ST(I)
      GO TO(13630,13610,13630,13610,13630,13610,13610), IST
C
C     TDY = STUDENT TYPES 2,4,6,7
13610 DO 13620 J=1,5
      J1= J+1
      TDYB(J1) = TDYB(J1) + SMYRS(J,I)
      IF( IPD .GT. 2 .AND. IPD .NE. 5)GO TO 13620
      TDYM(J1) = TDYM(J1) + SMYRS(J,I)
13620 CONTINUE
      GO TO 13650
```

```
C
C
C     PCS = STUDENT TYPES 1,3,5
13630 DO 13640 J=1,5
      J1= J+1
      PCSB(J1) = PCSB(J1) + SMYRS(J,I)
      IF(IPD .GT. 2) GO TO 13640
      PCSM(J1) = PCSM(J1) + SMYRS(J,I)
13640 CONTINUE
13650 CONTINUE
      GO TO 13690
C
C TYPE A (PCS). IFLAG=1
C
C    PCS-BASE OP. = SUM OF ALL STUDENTS.  TDY=0
C
13660 DO 13670 J=1,6
      PCSB(J) = V2(11,J)
13670 CONTINUE
C
C    PCS-MEDICAL = PERSONNEL DESIGNATOR 1,2,5
C
      DO 13685 I=1,NS
      IF(SPD(I) .GT. 2 .AND. SPD(I) .NE. 5)GO TO 13685
      DO 13680 J=1,5
      J1= J+1
      PCSM(J1) = PCSM(J1) + SMYRS(J,I)
13680 CONTINUE
13685 CONTINUE
C
C
13690 CONTINUE
C
C TYPE A MAN-YEARS (PCS)
C
C     CALCULATE SUM OF MILITARY INSTRUCTOR MAN-YEARS
C
13750 IF(NT .EQ. 0)GO TO 13835
      CALL INITF( TNMIL,6)
      DO 13825 I=1,NT
      IF(TPD(I) .GT. 2) GO TO 13825
      DO 13800 J=1,6
      TNMIL(J) = TNMIL(J) + TN(J,I)
13800 CONTINUE
13825 CONTINUE
C
13835 CONTINUE
C   (END OF TYPE A, TYPE B CALCULATIONS)
C**********************************************************************
C
C
      NA=NTYPE(A)
      IF(NA .EQ. 0)GO TO 14925
      DO 14900 I=1,NA
      IM = AIM(I)
      IPT = APT(I)-12
      GO TO(14100,14400,14700), IPT
```

```
C
C    ** TRAINING ADMINISTRATIVE **
C
14100 IF(IM .EQ. 2)GO TO 14300
C
C METHOD 1 -- CALCULATION
      DO 14200 J=2,6
      V2(17,J) =AFMPC(I)+AVMPCS(I)*(V2(11,J)+V2(12,J)+V2(13,J)+V2(14,J))
14200 CONTINUE
      GO TO 14900
C
C METHOD 2 -- THRUPUT
14300 DO 14325 J=1,6
      V2(17,J) = ANP(J,I)
14325 CONTINUE
      GO TO 14900
C
C    ** BASE OPERATING SUPPORT PERSONNEL **
C
14400 IF(IM .EQ. 2)GO TO 14600
C
C METHOD 1 -- CALCULATION
      DO 14500 J=1,6
      V2(18,J) = AFMPC(I) + AVMPCS(I)*(PCSB(J)+V2(12,J)+V2(13,J)+
     1                     V2(14,J)+V2(15,J)+V2(16,J)+V2(17,J))
     2                   + AVMTDY(I)*TDYB(J)
14500 CONTINUE
      GO TO 14900
C
C METHOD 2 -- THRUPUT
14600 DO 14625 J=1,6
      V2(18,J) = ANP(J,I)
14625 CONTINUE
      GO TO 14900
C
C    ** MEDICAL PERSONNEL **
C
14700 CONTINUE
C
C     CALCULATE SUM OF OTHER MILITARY PERSONNEL MAN-YEARS
C
      CALL INITF(OMIL,6)
      DO 14725 J=1,6
      OMIL(J)= OMIL(J) +(V2(14,J)*(QCOFF+QCAMN) + V2(15,J)*(QHOFF+QHAMN)
     1                 + V2(16,J)*(QFOFF+QFAMN) + V2(17,J)*(QAOFF+QAAMN)
     2                 + V2(18,J)*(QBOFF+QBAMN))/100.
14725 CONTINUE
C
      IF(IM .EQ. 2)GO TO 14800
C
C METHOD 1 -- CALCULATION
      DO 14750 J=1,6
      V2(19,J) = AFMPC(I) + AVMPCS(I)*(PCSM(J)+TNMIL(J)+OMIL(J))
     1                   + AVMTDY(I)*TDYM(J)
14750 CONTINUE
      GO TO 14900
```

```
C
C
C METHOD 2 -- THRUPUT
14800 DO 14825 J=1,6
      V2(19,J) = ANP(J,I)
14825 CONTINUE
      GO TO 14900
14900 CONTINUE
C
C ROUND TO 1 DECIMAL PLACE
14925 DO 14950 I=12,19
      DO 14950 J=1,6
      V2(I,J) = ROUND1(V2(I,J))
14950 CONTINUE
C
15000 CONTINUE
C TOTAL BASE PERMANENT PARTY
      DO 15100 J=1,6
      DO 15100 I=12,19
      V2(20,J) = V2(20,J) + V2(I,J)
15100 CONTINUE
C
C TOTAL COURSE MAN-YEARS
      DO 15200 J=1,6
      V2(21,J) = V2(20,J) + V2(11,J)
15200 CONTINUE
C
C ACTIVE DUTY FORCE PCS STUDENT LOAD
C ACTIVE DUTY FORCE TDY STUDENT LOAD
      IF(NS .EQ. 0)GO TO 15675
      IF(IFLAG .EQ. 1) GO TO 15400
C IFLAG=0 (TDY=LATERAL AND UPGRADE)
      DO 15300 I=1,NS
      IST = ST(I)
      IF(IST .GT. 2)GO TO 15300
      IF(IST .EQ. 1)IROW=22
      IF(IST .EQ. 2)IROW=25
      DO 15250 J=1,5
      J1 = J+1
      V2(IROW,J1) = V2(IROW,J1) + SMYRS(J,I)
15250 CONTINUE
15300 CONTINUE
      GO TO 15600
C IFLAG=1 (PCS = PIPELINE + LATERAL AND UPGRADE)
15400 DO 15500 I=1,NS
      IST = ST(I)
      IF(IST .GT. 2) GO TO 15500
      DO 15450 J=1,5
      J1 = J+1
      V2(22,J1) = V2(22,J1) + SMYRS(J,I)
15450 CONTINUE
15500 CONTINUE
15600 CONTINUE
```

```
C
C
C ROUND
C
      DO 15650 J=1,6
      V2(22,J) = ROUND1(V2(22,J))
      V2(25,J) = ROUND1(V2(25,J))
15650 CONTINUE
C
C BASE PERMANENT PARTY -- AF ONLY
15675 DO 15700 J=1,6
      V2(23,J) = V2(20,J) - V2(13,J)
15700 CONTINUE
C
C TOTAL PROGRAM 8 MAN-YEARS
      DO 15800 J=1,6
      V2(24,J) = V2(22,J) + V2(23,J)
15800 CONTINUE
C
C GUARD AND RESERVE STUDENT LOAD
      DO 15900 J=1,6
      V2(26,J) = V2(4,J) + V2(5,J) + V2(6,J)
15900 CONTINUE
C
C TOTAL AF MAN-YEARS
      DO 15950 J=1,6
      V2(27,J) = V2(24,J) + V2(25,J) + V2(26,J)
15950 CONTINUE
C
C ROW TOTALS
C
      DO 15975 I=1,27
      DO 15975 J=1,6
      V2(I,7) = V2(I,7) + V2(I,J)
15975 CONTINUE
C
C *** PRINT ***
C
      CALL HEAD
C
      WRITE(6,16100)
16100 FORMAT( 1H0, 41X, 28HMANPOWER SUMMARY (MAN-YEARS) /
     X        42X, 14(2H==) /
     X        75X, 4HYEAR / 1X /
     X        50X, 1H0, 9X, 1H1, 9X, 1H2, 9X, 1H3, 9X, 1H4,
     X         9X, 1H5, 9X, 5HTOTAL /
     X         5X, 8HSTUDENTS, 34X, 6(7H=======, 3X), 2X, 7H======= /
     X         7X, 17HACTIVE DUTY FORCE )
C
```

```
C
C
      WRITE(6,16200) ((V2(I,J),J=1,7), I=1,11  )
16200 FORMAT( 9X,  7HOFFICER,     28X,                    6F10.1, F12.1 /
     X        9X,  6HAIRMEN,      29X,                    6F10.1, F12.1 /
     X        9X,  8HCIVILIAN,    27X,                    6F10.1, F12.1 /
     X        7X, 17HGUARD AND RESERVE /
     X        9X,  7HOFFICER,     28X,                    6F10.1, F12.1 /
     X        9X,  6HAIRMEN,      29X,                    6F10.1, F12.1 /
     X        9X,  8HCIVILIAN,    27X,                    6F10.1, F12.1 /
     X        7X, 21HOTHER DOD (ARMY,NAVY)  /
     X        9X,  7HOFFICER,     28X,                    6F10.1, F12.1 /
     X        9X,  6HAIRMEN,      29X,                    6F10.1, F12.1 /
     X        9X,  8HCIVILIAN,    27X,                    6F10.1, F12.1 /
     X        7X, 13HNON-DOD (MAP), 24X,                  6F10.1, F12.1 /
     X                          47X, 6(7H-------, 3X), 2X, 7H-------   /
     X        5X, 20H* TOTAL STUDENT LOAD, 19X,           6F10.1, F12.1 )
C
      WRITE(6,16300) ((V2(I,J),J=1,7),I=12,21 )
16300 FORMAT( 1H0, 4X, 20HBASE PERMANENT PARTY  /
     X             7X, 11HINSTRUCTORS /
     X         9X,  9HAIR FORCE,  26X,                   6F10.1, F12.1 /
     X         9X, 21HOTHER DOD (ARMY,NAVY), 14X,        6F10.1, F12.1 /
     X         7X, 20HCURRICULUM PERSONNEL,  17X,        6F10.1, F12.1 /
     X         7X, 30HHARDWARE MAINTENANCE PERSONNEL,7X,6F10.1, F12.1 /
     X         7X,32HFACILITIES MAINTENANCE PERSONNEL,5X,6F10.1,F12.1 /
     X         7X,33HTRAINING ADMINISTRATIVE PERSONNEL,4X,6F10.1,F12.1/
     X         7X, 32HBASE OPERATING SUPPORT PERSONNEL,5X,6F10.1,F12.1 /
     X         7X, 17HMEDICAL PERSONNEL,          20X,   6F10.1, F12.1 /
     X                          47X, 6(7H-------, 3X), 2X, 7H-------   /
     X         5X, 28H* TOTAL BASE PERMANENT PARTY, 11X,6F10.1, F12.1 /
     X                          47X, 6(7H=======, 3X), 2X, 7H=======   /
     X         5X, 24H* TOTAL COURSE MAN-YEARS,15X, 6F10.1, F12.1/1X/1X)
C
      WRITE(6,16400) ((V2(I,J),J=1,7),I=22,27 )
16400 FORMAT(1H0,4X,34HACTIVE DUTY FORCE PCS STUDENT LOAD, 5X,
     X               6F10.1, F12.1/
     X         5X, 30HBASE PERMANENT PARTY - AF ONLY,  9X,6F10.1,F12.1/
     X                          47X, 6(7H-------, 3X), 2X, 7H-------   /
     X         5X, 27H* TOTAL PROGRAM 8 MAN-YEARS, 12X,  6F10.1, F12.1 /
     X         5X,34HACTIVE DUTY FORCE TDY STUDENT LOAD,5X,6F10.1,F12.1/
     X         5X, 30HGUARD AND RESERVE STUDENT LOAD,  9X,6F10.1,F12.1/
     X                          47X, 6(7H=======, 3X), 2X, 7H=======   /
     X         5X, 27H* TOTAL AIR FORCE MAN-YEARS, 12X,  6F10.1, F12.1 )
      RETURN
      END
```

```
C
C
C*********************************************************************
C   OUTPUT 3 -- COURSEWARE, HARDWARE, AND FACILITIES REQUIREMENTS
C*********************************************************************
C
      SUBROUTINE OUT3
C
C
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          TT,TPD,TPG,
     X          CID,CC,
     X          RIDX,RIMX,RID,RIM,
     X          HID,HC,HOD,
     X          EIDX,EIMX,EID,EIM,
     X          FID,
     X          GIDX,GIMX,GID,GIM
C
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),
C
     X          CID(75),CC(75),CTYPE(11,75),CCOPY(2,75),CMEAS(3,75),
     X          CNURQ(5,75),CNMU(75),CIPCM(75),CCCM(75),
     X          CPCC(75),CARV(75),CARP(75),
C
     X          RIDX(75),RIMX(75),RID(75),RIM(75),
     X          RNCHX(75),RMPCHX(75),RIPAX(75),RNPX(6,75),
     X          RNCH(75),RMPCH(75),RIPA(75),RNP(6,75),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75)
C
      DIMENSION EIDX(75),EIMX(75),EID(75),EIM(75),
     X          EDURX(5,75),EFRPHX(75),EAVRTX(75),ENPX(5,75),
     X          EDUR(5,75),EFRPH(75),EAVRT(75),ENP(5,75),
C
     X          FID(25),FTYPE(15,25),FCCPU(25),FNURQ(5,25),RVP(25),
C
     X          GIDX(25),GIMX(25),GID(25),GIM(25),
     X          GSFPFX(25),GMPSFX(25),GNPX(5,25),
     X          GSFPF(25),GMPSF(25),GNP(5,25)
C
      DIMENSION V1(13,8),YESNO(4),CREDT(2),TCHRS(5),
     X          TURNVR(5),UNITS1(5),UNITS2(5)
```

```
C
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
      COMMON/C/ CID,CC,CTYPE,CCOPY,CMEAS,CNURQ,CNMU,CIPCM,
     X          CCCM,CPCC,CARV,CARP
      COMMON/R/ RIDX,RIMX,RID,RIM,
     X          RNCHX,RMPCHX,RIPAX,RNPX,RNCH,RMPCH,RIPA,RNP
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
      COMMON/E/ EIDX,EIMX,EID,EIM,
     X          EDURX,EFRPHX,EAVRTX,ENPX,EDUR,EFRPH,EAVRT,ENP
      COMMON/F/ FID,FTYPE,FCCPU,FNURQ,RVP
      COMMON/G/ GIDX,GIMX,GID,GIM,
     X          GSFPFX,GMPSFX,GNPX,GSFPF,GMPSF,GNP
      COMMON /V1/ V1
C
      DATA YESNO(1)/2H N/, YESNO(2)/2HO /, YESNO(3)/2HYE/,
     X     YESNO(4)/2HS /
C*********************************************************************
C
      CALL HEAD
C
      WRITE(6,3100)
3100  FORMAT(1HO, 26X, 36HCOURSEWARE, HARDWARE, AND FACILITIES,
     X         21H REQUIREMENTS BY YEAR  /
     X       27X, 28(2H==),1H= / 1X / 1X   )
C
C          *** COURSEWARE ***
C
C
      WRITE(6,3200)
3200  FORMAT( 7X, 18H*** COURSEWARE ***,  36X,  7HINITIAL /
     X       36X,  4HNAME, 3X, 4HNAME, 15X,  5HPREP., 5X, 4HCOPY,
     X        6X,  6HANNUAL, 12X, 23HCOPIES REQUIRED BY YEAR  /
     X       37X,  2HOF, 5X, 2HOF, 5X,  8HMEASURES, 2X, 8HCOST($)/,
     X        2X,  8HCOST($)/, 2X, 8HREVISION,
     X       11X, 11(2H==),1H=  /
     X       36X,  4HCOPY, 2X, 7HMEASURE, 3X, 5H/COPY, 4X, 7HMEASURE,
     X        3X,  7HMEASURE, 3X, 7HRATE(%),
     X        9X, 1H1, 6X, 1H2, 6X, 1H3, 6X, 1H4, 6X, 1H5   /
     X       36X, 4H====, 2X, 7H=======, 4(2X, 8H========), 4X,
     X        5(2X, 5H=====)   )
C
      NC = NTYPE(C)
      IF(NC .EQ. 0) GO TO 5800
C*********************************************************************
C
C ** CALCULATE DEFAULT VALUE FOR NO. REQUIRED UNITS OF PRINTED MEDIA **
C
      NT = NTYPE(T)
      IF(NT .GT. 0) GO TO 3400
C
C NO. UNITS REQUIRED IN YEAR J = NO. ENTRANTS IN YEAR J  IF NO. INSTR. =0
      DO 3300 J=1,5
      UNITS1(J) = V1(12,J)
      UNITS2(J)=0.
3300  CONTINUE
      GO TO 3700
```

```
C
C
C CALCULATE NO. INSTRUCTOR MAN-YEARS  AND INSTR. TURNOVER IN YEARS 1-5
3400  CALL INITF( TCHRS,5)
      CALL INITF( TURNVR,5)
      DO 3500 I=1,NT
      DO 3500 J=1,5
      J1 = J+1
      TCHRS(J) = TCHRS(J) + TN(J1,I)
      TURNVR(J) = TURNVR(J) + TN(J1,I)*TTR(I)/100.
3500  CONTINUE
      DO 3550 J=1,5
      TURNVR(J) = ROUND0(TURNVR(J))
3550  CONTINUE
C
C     NO. UNITS REQUIRED
C
      UNITS1(1) = V1(12,1) + TCHRS(1) + TURNVR(1)
      UNITS2(1) = UNITS1(1) - V1(12,1)
      DO 3600 J=2,5
      UNITS1(J) = V1(12,J)+ AMAX1( (TCHRS(J)-TCHRS(J-1)),0.) + TURNVR(J)
      UNITS2(J) = UNITS1(J) - V1(12,J)
3600  CONTINUE
3700  CONTINUE
C*************************************************************************
C
C PRINTED MEDIA, CLASS=1 OR 2
C
      IC = 1
      WRITE(6,3800)
3800  FORMAT( 1X, 13HPRINTED MEDIA )
      GO TO 5000
C
C DISPLAY MEDIA, CLASS=3
C
4100  IC = 2
      WRITE(6,4200)
4200  FORMAT( 1X, 13HDISPLAY MEDIA  )
      GO TO 5000
C
C SOFTWARE, CLASS=4
C
4300  IC = 3
      WRITE(6,4400)
4400  FORMAT( 1X,  8HSOFTWARE  )
      GO TO 5000
4500  GO TO 6000
```

```
C
C
C       COURSEWARE "SUBROUTINE"
C
5000  NCC = 0
C
C SCAN FOR COURSEWARE CLASS "IC"
      DO 5500 I=1,NC
      IF(IC.EQ.1.AND.CC(I).LE.2)GO TO 5050
      IF(IC.EQ.2.AND.CC(I).EQ.3)GO TO 5050
      IF(IC.EQ.3.AND.CC(I).EQ.4)GO TO 5050
C
C ELSE...
      GO TO 5500
C
5050  NCC = NCC+1
      IF( IC .NE. 1) GO TO 5300
C
C CLASS=1 OR 2 (PRINTED). CALC CNURQ IF INPUT VALS. FOR YRS. 1-5 ALL = 0
      DO 5100 J=1,5
      IF( CNURQ(J,I) .NE. 0) GO TO 5300
5100  CONTINUE
C
C REPLACE INPUT VALUE WITH CALCULATED NO. UNITS REQUIRED
      DO 5200 J=1,5
      IF(CC(I).EQ.1)CNURQ(J,I)=UNITS1(J)
      IF(CC(I).EQ.2)CNURQ(J,I)=UNITS2(J)
5200  CONTINUE
5300  WRITE(6,5400) (CTYPE(J,I),J=1,11),(CCOPY(J,I),J=1,2),
     X              (CMEAS(J,I),J=1,3),CNMU(I),CIPCM(I),CCCM(I),CARV(I),
     X              (CNURQ(J,I), J=1,5)
5400  FORMAT( 3X, 11A2, 11X, 2A2, 2X, 3A2, 4X, F5.0, 3X, F8.2, 3X, F8.3,
     X        3X, F5.1,  6X, 5(1X, F6.0)   )
5500  CONTINUE
      IF(NCC .GT. 0) GO TO 5700
C
      WRITE(6,5600)
5600  FORMAT( 3X, 4HNONE)
C
5700  GO TO (4100, 4300, 4500), IC
C
C
5800  WRITE(6,5850)
5850  FORMAT( 11X, 12HNONE ENTERED  )
      GO TO 6000
C
C
C           *** HARDWARE ***
C
C
6000  NH = NTYPE(H)
      NOUT3L = NH+NC+24
      IF(NOUT3L .LE. LPP) GO TO 6050
      CALL HEAD
      NOUT3L = 10+NH
```

```
C
C
6050  WRITE(6,6100)
6100  FORMAT( 1X / 1X / 1X /
     X        7X, 16H*** HARDWARE ***, 23X, 6HREPAIR, 33X, 7HTIME TO /
     X       47X,  4HPART, 6X, 7H STOCK , 2X, 6HANNUAL,
     X        3X,  8HFAILURES, 2X, 7HREPAIR/,
     X        7X, 22HUNITS REQUIRED BY YEAR  /
     X       36X,  4HUNIT, 6X, 8HCOST($)/, 2X, 8H  FUND  , 3X, 4HLOSS,
     X        4X,  8H/HOUR OF, 2X, 7HFAILURE, 7X, 11(2H==) /
     X       36X,  7HCOST($), 3X, 8HUNIT/YR., 3X, 6H ITEM ,
     X        3X,  7HRATE(%), 3X, 5HUSAGE, 4X, 7H(HOURS), 4X, 1H1,
     X        6X,  1H2, 6X, 1H3, 6X, 1H4, 6X, 1H5 /
     X       36X, 4(2H==), 2X, 4(2H==),
     X        2X,  4(2H==), 2X, 7H=======, 2X, 4(2H==), 2X, 7H=======,
     X        5(2X, 5H=====)    )
C
      IF(NH .EQ. 0) GO TO 7200
C
C MEDIA HARDWARE, CLASS=1
C
      IC = 1
      WRITE(6,6150)
6150  FORMAT( 1X, 14HMEDIA HARDWARE )
      GO TO 6700
C
C SPECIAL EQUIPMENT, CLASS=2
C
6200  IC = 2
      WRITE(6,6300)
6300  FORMAT( 1X, 17HSPECIAL EQUIPMENT  )
      GO TO 6700
C
C OVERHEAD HARDWARE, CLASS=3
C
6400  IC = 3
      WRITE(6,6500)
6500  FORMAT( 1X, 17HOVERHEAD HARDWARE  )
      GO TO 6700
6600  GO TO 7500
C
C       HARDWARE "SUBROUTINE"
C
6700  NHC = 0
C
C SCAN FOR HARDWARE CLASS "IC"
      DO 7000 I=1,NH
      IF( HC(I) .NE. IC) GO TO 7000
      NHC = NHC+1
C
      IF (SFD(I).EQ.0) INDEX = 1
      IF (SFD(I).EQ.1) INDEX = 3
      INDEX1 = INDEX + 1
      CREDT(1) = YESNO(INDEX)
      CREDT(2) = YESNO(INDEX1)
```

```
C
C
C INPUT METHOD = CALCULATION
      IF( EIM(I) .EQ. 1)
     X WRITE(6, 6800) (HTYPE(J,I), J=1,15),
     X                HPCU(I), HRCUY(I),CREDT(1),CREDT(2), HAAF(I),
     X                EFRPH(I), EAVRT(I), (HNURQ(J,I), J=1,5)
6800  FORMAT( 3X,  15A2, 2X, F9.0, 2X, F7.0, 6X, 2A2,4X, F5.1,
     X        3X,  F7.5, 3X, F7.4, 5(2X, F5.0)  )
C
C INPUT METHOD = THRUPUT
      IF( EIM(I) .EQ. 2 .OR. EIM(I) .EQ. 0)
     X WRITE(6,6900) (HTYPE(J,I), J=1,15),
     X               HPCU(I), HRCUY(I),CREDT(1),CREDT(2), HAAF(I),
     X               (HNURQ(J,I), J=1,5)
6900  FORMAT( 3X,  15A2, 2X, F9.0, 2X, F7.0, 6X, 2A2,4X, F5.1,
     X        5X, 3H---, 6X, 3H---, 2X, 5(2X,F5.0) )
7000  CONTINUE
C
      IF( NHC .GT. 0) GO TO 7100
      WRITE( 6,5600)
7100  GO TO ( 6200, 6400, 6600), IC
7200  WRITE(6,5850)
      GO TO 7500
C
C
C           *** FACILITIES ***
C
C
7500  NF = NTYPE(F)
      IF((NOUT3L+8+NF) .GT. LPP) CALL HEAD
      WRITE(6,7600)
7600  FORMAT( 1X / 1X / 1X /
     X        7X, 18H*** FACILITIES *** , 32X, 6HMAINT.  /
     X       46X,  6HSQUARE, 4X, 9HMAN-HOURS,
     X       34X, 22HUNITS REQUIRED BY YEAR  /
     X       36X, 4HUNIT, 7X, 5HFEET/, 4X, 8H/SQ. FT.,
     X       35X, 11(2H==)   /
     X       36X, 7HCOST($), 3X, 8HFACILITY, 2X, 6H/MONTH,
     X       34X, 1H1, 6X, 1H2, 6X, 1H3, 6X, 1H4, 6X, 1H5  /
     X       34X, 3(2X, 8H========) , 28X, 5(2X, 5H=====)  )
C
      IF( NF .EQ. 0) GO TO 8500
      WRITE(6,7700)
7700  FORMAT( 1X, 4HNAME)
      DO 8000 I=1,NF
C
C INPUT METHOD = CALCULATION
      IF(GIM(I) .EQ. 1)
     X WRITE(6,7800) (FTYPE(J,I), J=1,15), FCCPU(I), GSFPF(I),
     X                GMPSF(I), (FNURQ(J,I), J=1,5)
7800  FORMAT( 3X, 15A2, 2X, F9.0, 2X, F8.0, 2X, F8.5,
     X       28X, 5(2X, F5.0)  )
C
```

```
C
C
C INPUT METHOD = THRUPUT
      IF(GIM(I) .EQ. 2 .OR. GIM(I) .EQ. 0)
     X WRITE(6,7900) (FTYPE(J,I), J=1,15), FCCPU(I),
     X                (FNURQ(J,I), J=1,5)
7900  FORMAT( 3X, 15A2, 2X, F9.0, 4X, 3H---, 7X, 3H---,
     X       31X, 5(2X, F5.0)  )
8000  CONTINUE
      GO TO 9000
8500  WRITE(6,5850)
      GO TO 9000
9000  RETURN
      END
```

```
C
C
C*************************************************************************
C   OUTPUT 4 -- FUNCTIONAL COST SUMMARY
C*************************************************************************
C
      SUBROUTINE OUT4
C
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          ST,SPD,SPG,SIM,
     X          TT,TPD,TPG,
     X          CIB,CC,
     X          HID,HC,HOD,
     X          FID
C
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          OFF(10),AM*(9),CGS(18),CWB(14),FOR(20)
C
      DIMENSION ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
C
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),
C
     X          CID(75),CC(75),CTYPE(11,75),CCOPY(2,75),CMEAS(3,75),
     X          CNURQ(5,75),CNMU(75),CIPCM(75),CCCM(75),
     X          CPCC(75),CARV(75),CARP(75),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75),
C
     X          FID(25),FTYPE(15,25),FCCPU(25),FNURQ(5,25),RVP(25),
C
     X          BSC(5),
C
     X          PAY(20,5),PAYAV(5)
C
      DIMENSION AV(6),ALOSS(6),PROC(6),V4(30,7),V2(27,7),
     X          PCSOFF(5),PCSAMN(5),PCSCIV(5),
     X          TDYEOF(5),TDYEAM(5),TDYECV(5),
     X          TDYMOF(5),TDYMAM(5),TDYMCV(5),
     X          AMOVOF(6),AMOVAM(6),AMOVCV(6),
     X          EDREQ(6),DEBIT(6),CREDIT(6)
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
      COMMON/C/ CID,CC,CTYPE,CCOPY,CMEAS,CNURQ,CNMU,CIPCM,
     X          CCCM,CPCC,CARV,CARP
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
      COMMON/F/ FID,FTYPE,FCCPU,FNURQ,RVP
```

```
C
C
      COMMON/B/ BSC
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
      COMMON/PAY/ PAY, PAYAV
      COMMON/V2/ V2
      COMMON/V4/ V4
C*****************************************************************************
C
C
      CALL INITF(V4,210)
C
C
C          *** COURSEWARE ***
C
C
900   CONTINUE
      CALL INITF(AV,5)
      CALL INITF(ALOSS,5)
      CALL INITF(PROC,5)
      NC = NTYPE(C)
      IF(NC .EQ. 0) GO TO 1500
C
      DO 1400 I=1,NC
      CARPP = CARP(I)/100.
      CARVP = CARV(I)/100.
      IF(CC(I).EQ.1 .OR. CC(I).EQ.2)IROW=1
      IF(CC(I).EQ.3)                IROW=2
      IF(CC(I).EQ.4)                IROW=3
      GO TO (1200, 1000, 1000), IROW
C
C          * DISPLAY *     * SOFTWARE *
C
C YEAR 1
1000  AV(1) = 0.
      ALOSS(1) = ROUND0( CARPP*CNURQ(1,I) )
      PROC(1) = CNURQ(1,I)+ALOSS(1)-AV(1)
      V4(IROW,2) = V4(IROW,2) +
     X             CNMU(I)*CIPCM(I)*(CARVP+1.) +
     X             CNMU(I)*CCCM(I)*(PROC(1)+CNURQ(1,I)*CARVP) +
     X             PROC(1)*CPCC(I)
C
C YEARS 2-5
      DO 1100 J=2,5
      AV(J) = AV(J-1)+PROC(J-1)-ALOSS(J-1)
      ALOSS(J) = ROUND0(CARPP*CNURQ(J,I))
      PROC(J) = AMAX1(( CNURQ(J,I)+ALOSS(J)-AV(J)), 0. )
```

```
C
C
C COST = PROCURE. COST FOR INCREASE IN STUDENT LOAD +
C        INITIAL REVISION PREP. COST + REVISION COPY COST +
C        PACKAGING COST
C
      V4(IROW,J+1) = V4(IROW,J+1) + PROC(J)*CNMU(I)*CCCM(I)
     X                             + CARVP*CNMU(I)*CIPCM(I)
     X                             + CARVP*CNMU(I)*CNURQ(J,I)*CCCM(I)
     X                             + PROC(J)*CPCC(I)
1100  CONTINUE
      GO TO 1400
C
C          * PRINTED *
C
1200  CONTINUE
      DO 1250 J=1,5
      ALOSS(J) = ROUNDO(CARPP*CNURQ(J,I))
      PROC(J) = CNURQ(J,I)+ALOSS(J)
1250  CONTINUE
C
      V4(IROW,2) = V4(IROW,2) + (CARVP+1.)*
     X             (CNMU(I)*CIPCM(I)+PROC(1)*CNMU(I)*CCCM(I))
     X           + PROC(1)*CPCC(I)
      DO 1300 J=2,5
      V4(IROW,J+1) = V4(IROW,J+1) +  PROC(J)*CNMU(I)*CCCM(I) +
     X                               CARVP*CNMU(I)*CIPCM(I)   +
     X                               CARVP*CNMU(I)*PROC(J)*CCCM(I)   +
     X                               PROC(J)*CPCC(I)
1300  CONTINUE
1400  CONTINUE
      GO TO 1500
C
C
C          *** HARDWARE ***
C
C
1500  CONTINUE
      NH = NTYPE(H)
      IF(NH .EQ. 0) GO TO 2000
C
      DO 1800 I=1,NH
      IROW = HC(I) + 3
      CALL HDWRE(I,DEBIT,CREDIT)
C COST - YEARS 1-5
      DO 1700 J=1,6
      HWCOST =  DEBIT(J)*HPCU(I) + CREDIT(J)*HPCU(I)*CRV(I)/100.0
     X                + HRCUY(I)*DEBIT(J)*HISR(I)/12.
      V4(IROW,J) = V4(IROW,J) + HWCOST
1700  CONTINUE
1800  CONTINUE
      GO TO 2000
```

```
C
C
C          *** FACILITY CONSTRUCTION ***
C
C
2000  CALL INITF( AV,6)
      CALL INITF( PROC,6)
      IROW = 7
      NF= NTYPE(F)
      IF( NF .EQ. 0) GO TO 2500
C
      DO 2200 I=1,NF
C YEAR 1
      AV(1) = 0.0
      PROC(1) = ( FNURQ(1,I)-AV(1))
      V4(IROW,1) = V4(IROW,1) + PROC(1)*FCCPU(I)
C YEARS 2-5
      DO 2100 J=2,5
      AV(J) = AV(J-1)+PROC(J-1)
      PROC(J) = ( FNURQ(J,I) - AV(J))
      V4(IROW,J) = V4(IROW,J) + PROC(J)*FCCPU(I)
2100  CONTINUE
      AV(6) = AV(5) + PROC(5)
      PROC(6) = - AV(6)
      V4(IROW,6) = V4(IROW,6) + PROC(6)*FCCPU(I)*RVP(I)/100.0
2200  CONTINUE
      GO TO 2500
C
C
C          *** PAY AND ALLOWANCES ***
C
C
C          STUDENTS
C
2500  NS = NTYPE(S)
      IF( NS .EQ. 0) GO TO 2900
      IROW = 8
C
      DO 2700 I=1,NS
      CALL PAYGR(SPG(I),SPD(I),PG)
      DO 2600 J=1,5
      V4(IROW,J+1) = V4(IROW,J+1) + SMYRS(J,I)*PG
2600  CONTINUE
2700  CONTINUE
      GO TO 2900
C
C          INSTRUCTORS
C
2900  NT = NTYPE(T)
      IF( NT .EQ. 0) GO TO 3500
      IROW = 9
C
      DO 3100 I=1,NT
      CALL PAYGR( TPG(I),TPD(I),PG)
      DO 3000 J=1,6
      V4(IROW,J) = V4(IROW,J) + TN(J,I)*PG
3000  CONTINUE
3100  CONTINUE
      GO TO 3500
```

```
C
C
C          CURRICULUM (IROW=10),   HARDWARE (IROW=11),
C          FACILITIES (IROW=12),   TRAINING ADMIN. (IROW=13),
C          BASE. OPER. (IROW=14),  MEDICAL (IROW=15)
C
3500  DO 3600 J=1,6
      IROW = 10
      V4(IROW,J) = (QCOFF*PAYAV(1)+QCAMN*PAYAV(2)+QCCIV*PAYAV(3))/100.
     1             * V2(14,J)
      IROW = IROW+1
      V4(IROW,J) = (QHOFF*PAYAV(1)+QHAMN*PAYAV(2)+QHCIV*PAYAV(4))/100.
     1             *V2(15,J)
      IROW = IROW+1
      V4(IROW,J) = (QFOFF*PAYAV(1)+QFAMN*PAYAV(2)+QFCIV*PAYAV(4))/100.
     1             *V2(16,J)
      IROW = IROW+1
      V4(IROW,J) = (QAOFF*PAYAV(1)+QAAMN*PAYAV(2)+QACIV*PAYAV(3))/100.
     1             *V2(17,J)
      IROW = IROW+1
      V4(IROW,J) = (QBOFF*PAYAV(1)+QBAMN*PAYAV(2)+QBCIV*PAYAV(4))/100.
     1             *V2(18,J)
      IROW = IROW+1
      V4(IROW,J) = (QMOFF*PAYAV(1)+QMAMN*PAYAV(2)+QMCIV*PAYAV(3))/100.
     1             *V2(19,J)
3600  CONTINUE
      GO TO 4000
C
C
C          *** PCS COSTS ***
C
C
C          STUDENTS
C
4000  CONTINUE
      IROW = 16
      KROW = 18
      NS = NTYPE(S)
      IF(NS .EQ. 0) GO TO 5500
C
      DO 5100 I=1,NS
      IST = ST(I)
      IPD = SPD(I)
      IF(IST .EQ. 7)GO TO 5100
      IF( IFLAG .EQ. 1) GO TO 4100
C
C IF COURSE DUR. UNDER 20 WEEKS. PCS = STUDENT TYPES 1,3,5 ONLY
C                                TDY = STUDENT TYPES 2,4,6
C
      GO TO( 4100, 5100, 4100, 5100, 4100, 5100, 5100), IST
4100  CALL PCSST(I,PCSOFF,PCSAMN,PCSCIV)
      DO 5000 J=1,5
      V4(IROW,J+1) = V4(IROW,J+1) + (PCSOFF(J)*QCPMSO +
     X                    PCSAMN(J)*QCPMSA + PCSCIV(J)*QCPMSC)
5000  CONTINUE
5100  CONTINUE
      GO TO 5500
```

```
C
C
C           INSTRUCTORS
C
5500  IROW = 17
      KROW = 21
      NT = NTYPE(T)
      IF(NT .EQ. 0)GO TO 6500
C
      DO 6100 I=1,NT
      CALL PCSIN(I,AMOVOF,AMOVAM,AMOVCV,EDREQ )
C
      DO 5600 J=1,6
      V4(IROW,J) =  V4(IROW,J) + ROUND0(AMOVOF(J))*QCPMIO +
     X                           ROUND0(AMOVAM(J))*QCPMIA +
     X                           ROUND0(AMOVCV(J))*QCPMIC
      V4(KROW,J) = V4(KROW,J) + TETC(I)*ROUND0(EDREQ(J))
C           EDUCATION TRAINING
C
5600  CONTINUE
6100  CONTINUE
6200  CONTINUE
      GO TO 6500
C
C
C           *** TDY COSTS ***
C
C
C           TRANSPORTATION AND PER DIEM
C
6500  IF(IFLAG .EQ. 1) GO TO 6800
      IF(NS .EQ. 0)GO TO 6800
      IROW = 18
      KROW = 19
      DO 6650 I=1,NS
      IST = ST(I)
      IPD = SPD(I)
      GO TO(6650,6550,6650,6550,6650,6550,6650),IST
6550  CALL TDYST(I, TDYEOF,TDYEAM,TDYECV,
     X             TDYMOF,TDYMAM,TDYMCV )
      DO 6600 J=1,5
      V4(IROW,J+1) = V4(IROW,J+1) +(TDYEOF(J)+TDYEAM(J)
     X                          + TDYECV(J))*QTDYTC
      V4(KROW,J+1) = V4(KROW,J+1) +(TDYMOF(J)*QTDYOF +
     X                TDYMAM(J)*QTDYAM + TDYMCV(J)*QTDYCV)*365.
6600  CONTINUE
6650  CONTINUE
C
      GO TO 6800
```

```
C
C
C           *** INSTRUCTOR TRAINING ***
C
C
C           FACTORY TRAINING OF INITIAL INSTR. CADRE
C
6800  IROW = 20
      NJ = NTYPE(4)
      DO 6850 J = 1,NJ
 6850 V4(IROW,1) = V4(IROW,1) + TSIIC(J)*TIFTC(J)
C
C           EDUCATION TRAINING (SEE PCS COSTS ABOVE)
C
C
C
C           *** MISCELLANEOUS COSTS ***
C
C
C           COMPUTER SERVICE CHARGES
C
6900  CONTINUE
      IROW = 22
      DO 7000 J=1,5
      V4(IROW,J+1) = BSC(J)
7000  CONTINUE
C
C           HARDWARE REPAIR PARTS
C
7050  CONTINUE
      KROW = 23
      IROW = 24
      IF(NH .EQ. 0)GO TO 7150
      DO 7100 I=1,NH
      DO 7100 J=1,5
      V4(KROW,J+1) = V4(KROW,J+1) + HCMTC(I)*HNURQ(J,I)
      V4(IROW,J+1) = V4(IROW,J+1) + HNURQ(J,I)*HRCUY(I)
7100  CONTINUE
C
C           PERSONNEL SUPPLIES
C
7150  IROW = 25
      DO 7200 J=1,6
      V4(IROW,J) = V2(21,J)*QMSCPM
7200  CONTINUE
C
7250  CONTINUE
C
C           GET COST IN $/K, THEN ROUND TO 1 DECIMAL PLACE
C
      DO 7300 I=1,25
      DO 7300 J=1,6
      V4(I,J) = ROUND1( V4(I,J)/1000.)
7300  CONTINUE
```

```
C
C
C           CALCULATE COLUMN TOTALS
C
      DO 7400 J=1,6
      DO 7400 I=1,25
      V4(26,J) = V4(26,J) + V4(I,J)
7400  CONTINUE
C
C           CALCULATE ROW TOTALS
C
      DO 7500 I=1,26
      DO 7500 J=1,6
      V4(I,7) = V4(I,7) + V4(I,J)
7500  CONTINUE
C
      DO 7700 J = 1,6
      J1 = J - 1
      V4(30,J) = V4(26,J) / ((1.0+QDR/100.0)**J1)
 7700 V4(30,7) = V4(30,7) + V4(30,J)
C
C
C           ***PRINT***
C
C
      CALL HEAD
C
      WRITE(6,8100)
8100  FORMAT( 1H0, 30X, 40HFUNCTIONAL COST SUMMARY (IN THOUSANDS OF,
     X              9H DOLLARS)  / 31X, 24(2H==),1H= / 1X   /
     X        78X, 4HYEAR / 1X /
     X        54X, 1H0, 9X, 1H1, 9X, 1H2, 9X, 1H3, 9X, 1H4,
     X         9X, 1H5, 9X, 5HTOTAL /
     X        48X, 6(3X, 7H=======), 5X, 7H=======   )
C
      WRITE(6,8200) (( V4(I,J), J=1,7), I=1,7  )
8200  FORMAT( 1X, 22HCOURSEWARE PROCUREMENT    /
     X        3X, 13HPRINTED MEDIA,                                  32X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        3X, 13HDISPLAY MEDIA,                                  32X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        3X,  8HSOFTWARE,                                       37X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        1X, 20HHARDWARE PROCUREMENT      /
     X        3X, 14HMEDIA HARDWARE,                                 31X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        3X, 17HSPECIAL EQUIPMENT,                              28X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        3X, 17HOVERHEAD HARDWARE,                              28X,
     X            6(2X, F8.1), 3X, F9.1 /
     X        1X, 21HFACILITY CONSTRUCTION                           26X,
     X            6(2X, F8.1), 3X, F9.1        )
C
```

```
C
C
      WRITE(6,8300) (( V4(I,J),J=1,7), I=8,15 )
8300  FORMAT( 1X, 18HPAY AND ALLOWANCES    /
     X        3X,  8HSTUDENTS,                                        37X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 11HINSTRUCTORS,                                     34X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 20HCURRICULUM PERSONNEL,                            25X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 30HHARDWARE MAINTENANCE PERSONNEL,                  15X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 32HFACILITIES MAINTENANCE PERSONNEL,                13X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 33HTRAINING ADMINISTRATIVE PERSONNEL,               12X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 32HBASE OPERATING SUPPORT PERSONNEL,                13X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 17HMEDICAL PERSONNEL,                               28X,
     X           6(2X, F8.1), 3X, F9.1    )
C
      WRITE(6,8400) (( V4(I,J),J=1,7), I=16,21 )
8400  FORMAT( 1X,  9HPCS COSTS  /
     X        3X,  8HSTUDENTS,                                        37X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 11HINSTRUCTORS,                                     34X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        1X,  9HTDY COSTS  /
     X        3X, 14HTRANSPORTATION,                                  31X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 20HDESTINATION PER DIEM,                            25X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        1X, 19HINSTRUCTOR TRAINING   /
     X        3X, 40HFACTORY TRAINING OF INITIAL INSTR. CADRE,         5X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 18HEDUCATION TRAINING,                              27X,
     X           6(2X, F8.1), 3X, F9.1     )
C
      WRITE(6,8500) (( V4(I,J),J=1,7), I=22,26 )
8500  FORMAT( 1X, 29HMISCELLANEOUS OPERATING COSTS   /
     X        3X, 24HCOMPUTER SERVICE CHARGES,                        21X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X,29HHARDWARE CONTRACT MAINTENANCE,          16X,
     X          6(2X,F8.1),3X,F9.1 /
     X        3X, 35HHARDWARE REPLENISHMENT REPAIR PARTS,             10X,
     X           6(2X, F8.1), 3X, F9.1 /
     X        3X, 22HMISCELLANEOUS SUPPLIES,                          23X,
     X           6(2X, F8.1), 3X, F9.1 /
     X       48X, 6(3X, 7H=======), 5X, 7H======= / 1X /
     X        1X, 17HTOTAL COURSE COST,                               30X,
     X           6(1X, F9.1), 2X, F10.1 / 1X )
      WRITE(6,8600) QDR,(V4(30,J),J=1,7)
 8600 FORMAT(1X,
     X 'DISCOUNTED COURSE COST (AT ',F5.1,'%)',13X,
     X 6(1X,F9.1),2X,F10.1 /)
C
      RETURN
      END
```

```
C
C
C*************************************************************************
C          OUTPUT 5 -- PROGRAM/APPROPRIATION COST SUMMARY
C*************************************************************************
C
      SUBROUTINE OUT5
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P,
     X          ST,SPD,SPG,SIM,
     X          TT,TPD,TPG,
     X          HID,HC,HOD
C
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39),
     X          OFF(10),AMN(9),CG3(18),CWB(14),FOR(20),
C
     X          ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75),
C
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75),
C
     X          PAY(20,5),PAYAV(5),
C
     X          PCSOFF(5),PCSAMN(5),PCSCIV(5),
     X          TDYEOF(5),TDYEAM(5),TDYECV(5),
     X          TDYMOF(5),TDYMAM(5),TDYMCV(5),
     X          AMOVOF(6),AMOVAM(6),AMOVCV(6),
     X          EDREQ(6),DEBIT(6),CREDIT(6),
C
     X          V2(27,7),V4(30,7),V5(28,7)
C
      COMMON/ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
      COMMON/PAY/ PAY, PAYAV
      COMMON/V2/ V2
      COMMON/V4/ V4
```

```
C
C
C*************************************************************************
C
C
      CALL INITF(V5,196)
C
C
C
C           *** PCS/TDY COSTS ***
C
C
C           * STUDENTS *
C
50    CONTINUE
      NS = NTYPE(S)
      IF(NS .EQ. 0)GO TO 1005
      DO 1000 I=1,NS
      IPD = SPD(I)
      IST = ST(I)
      CALL PCSST(I,PCSOFF,PCSAMN,PCSCIV)
      IF(IFLAG .EQ. 0)GO TO 850
      GO TO(100,100,350,350,600,600,1000),IST
C
C
C               PCS
C               ---
C
C ACTIVE DUTY FORCE
C
100   GO TO(150,150,250,250,1000),IPD
C
C           OFFICERS, AIRMEN
C
150   IROW = 9
      DO 200 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) +
     X               (PCSOFF(J)*QCPMSO + PCSAMN(J)*QCPMSA)
200   CONTINUE
      GO TO 1000
C
C           CIVILIANS
C
250   IROW = 3
      KROW = 18
      DO 300 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) + QCPMSC * SENTS(J,I)
      V5(KROW,J+1) = V5(KROW,J+1) + QCPMSC * (SNGRAD(J,I)+SNWASH(J,I))
300   CONTINUE
      GO TO 1000
```

```
C
C
C RESERVE OR GUARD
C
350   GO TO(400,400,500,500,1000),IPD
C
C           OFFICERS, AIRMEN
C
400   IROW=15
      DO 450 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) +
     X                (PCSOFF(J)*QCPMSO + PCSAMN(J)*QCPMSA)
450   CONTINUE
      GO TO 1000
C
C           CIVILIANS
C
500   IROW = 12
      DO 550 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) + (PCSCIV(J)*QCPMSC)
550   CONTINUE
      GO TO 1000
C
C OTHER DOD
C
C
600   GO TO(650,650,750,750,1000),IPD
C
C           OFFICERS, AIRMEN
C
650   IROW = 26
      DO 700 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) +
     X                (PCSOFF(J)*QCPMSO + PCSAMN(J)*QCPMSA)
700   CONTINUE
      GO TO 1000
C
C           CIVILIANS
C
750   IROW = 23
      DO 800 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) + (PCSCIV(J)*QCPMSC)
800   CONTINUE
      GO TO 1000
C
C
C              TDY
C              ---
C
850   GO TO(100,875,350,875,600,875,1000),IST
C
C LATERAL AND UPGRADE (REG. FORCE, RESERVE/GUARD, OTHER DOD)
C
875   CALL TDYST(I,TDYEOF,TDYEAM,TDYECV,
     X           TDYMOF,TDYMAM,TDYMCV )
      IF(IST .EQ. 4)GO TO 925
      IF(IST .EQ. 2)IROW=18
      IF(IST .EQ. 6)IROW=23
```

```
C
C
C ACTIVE DUTY FORCE, RESERVE/GUARD
C
C           OFFICERS,AIRMEN,CIVILIANS
C
      DO 900 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) +
     X                    (TDYEOF(J)+TDYEAM(J)+TDYECV(J))*QTDYTC +
     X                    (TDYMOF(J)*QTDYOF +
     X                     TDYMAM(J)*QTDYAM +
     X                     TDYMCV(J)*QTDYCV  )*365.
900   CONTINUE
      GO TO 1000
C
C OTHER DOD
C
925   GO TO(950,950,985,985,1000),IPD
C
C           OFFICERS, AIRMEN
C
950   IROW=15
      DO 975 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) + (TDYEOF(J)+TDYEAM(J))*QTDYTC +
     X                                  (TDYMOF(J)*QTDYOF +
     X                                   TDYMAM(J)*QTDYAM )*365.
975   CONTINUE
      GO TO 1000
C
C           CIVILIANS
C
985   IROW = 12
      DO 990 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) +TDYECV(J)*QTDYTC +
     X                                 TDYMCV(J)*QTDYCV*365.
990   CONTINUE
      GO TO 1000
C
1000  CONTINUE
C
C            * INSTRUCTORS *
C
C
1005  NT = NTYPE(T)
      IF(NT .EQ. 0)GO TO 1090
      DO 1050 I=1,NT
      IPD = TPD(I)
      ITT = TT(I)
      CALL PCSIN(I,AMOVOF,AMOVAM,AMOVCV,EDREQ)
      GO TO(1010,1010,1030,1030,1050),IPD
```

```
C
C
C           OFFICERS, AIRMEN
C
1010  IF(ITT .EQ. 8)IROW=9
      IF(ITT .EQ. 9)IROW=26
      DO 1020 J=1,6
      V5(IROW,J) = V5(IROW,J) + ROUNDO(AMOVOF(J))*QCPMIO +
     X                          ROUNDO(AMOVAM(J))*QCPMIA
1020  CONTINUE
      GO TO 1050
C
C           CIVILIANS
C
1030  IF(ITT .EQ. 9)GO TO 1042
C
C  AIR FORCE
C
      IROW=3
      JROW=18
      DO 1040 J=1,6
      TERM = ROUNDO(AMOVCV(J))*QCPMIC/2.
      V5(IROW,J) = V5(IROW,J) + TERM
C
C (THE OTHER HALF)
C
      V5(JROW,J) = V5(JROW,J) + TERM
1040  CONTINUE
      GO TO 1050
C
C  OTHER DOD
C
1042  IROW = 23
      DO 1045 J=1,6
      V5(IROW,J) = V5(IROW,J) + ROUNDO(AMOVCV(J))*QCPMIC
1045  CONTINUE
      GO TO 1050
C
1050  CONTINUE
C
C
C*************************************************************************
C
C
C      *** PAY AND ALLOWANCES ***
C
C            * STUDENTS *
C
1090  IF(NS .EQ.0)GO TO 1325
      DO 1300 I=1,NS
      IST = ST(I)
      IPD = SPD(I)
      IF(IST .GT. 2)GO TO 1175
```

```
C
C
C  ACTIVE DUTY FORCE
C
      IF(IFLAG .EQ. 0)GO TO 1125
C
C  PIPELINE,LATERAL/UPGRADE = PCS
C
1100  IF(IPD .EQ. 1)IROW=7
      IF(IPD .EQ. 2)IROW=8
      IF(IPD .EQ. 3)IROW=2
      IF(IPD .EQ. 4)IROW=2
      GO TO 1260
C
C  TDY/PCS
C
1125  GO TO(1100,1150),IST
C
C  LATERAL/UPGRADE = TDY
C
1150  IF(IPD .EQ. 1)IROW=19
      IF(IPD .EQ. 2)IROW=20
      IF(IPD .EQ. 3)IROW=17
      IF(IPD .EQ. 4)IROW=17
      GO TO 1260
C
1175  GO TO(1300,1300,1200,1200,1225,1225,1250),IST
C
C  RESERVE/GUARD
C
1200  IF(IPD .EQ. 1)IROW=13
      IF(IPD .EQ. 2)IROW=14
      IF(IPD .EQ. 3)IROW=11
      IF(IPD .EQ. 4)IROW=11
      GO TO 1260
C
C  OTHER DOD
C
1225  IF(IPD .EQ. 1)IROW=24
      IF(IPD .EQ. 2)IROW=25
      IF(IPD .EQ. 3)IROW=22
      IF(IPD .EQ. 4)IROW=22
      GO TO 1260
C
C  NON-DOD
C
1250  IROW = 27
1260  CALL PAYGR(SPG(I),SPD(I),PG)
      DO 1275 J=1,5
      V5(IROW,J+1) = V5(IROW,J+1) + SMYRS(J,I)*PG
1275  CONTINUE
C
1300  CONTINUE
```

```
C
C
C            * INSTRUCTORS *
C
1325  IF(NT .EQ. 0)GO TO 1380
      DO 1375 I=1,NT
      ITT = TT(I)
      IPD = TPD(I)
      IF(ITT .EQ. 9)GO TO 1350
C
C   AIR FORCE
C
      IF(IPD .EQ. 1)IROW=7
      IF(IPD .EQ. 2)IROW=8
      IF(IPD .EQ. 3)IROW=2
      IF(IPD .EQ. 4)IROW=2
      GO TO 1360
C
C   OTHER DOD
C
1350  IF(IPD .EQ. 1)IROW=24
      IF(IPD .EQ. 2)IROW=25
      IF(IPD .EQ. 3)IROW=22
      IF(IPD .EQ. 4)IROW=22
C
1360  CALL PAYGR(TPG(I),TPD(I),PG)
      DO 1370 J=1,6
      V5(IROW,J) = V5(IROW,J) + TN(J,I)*PG
1370  CONTINUE
C
1375  CONTINUE
C
1380  CONTINUE
C
C
C*************************************************************************
C
C            *** AIR FORCE ***
C
C            * PROGRAM 8 *
C            MILITARY CONSTRUCTION
C
1600  CONTINUE
C  IROW=1,(5)
      DO 1700 J=1,6
      IF(V4(7,J) .GE. 50.)IROW=1
      IF(V4(7,J) .LT. 50.)IROW=5
      V5(IROW,J) = V4(7,J)*1000.
1700  CONTINUE
```

```
C
C
C           OPERATIONS AND MAINTENANCE
C
C CIVILIAN PERSONNEL
      IROW = 2
C  (ALSO SEE PAY AND ALLOWANCES CALCULATION)
      DO 2600 J=1,6
      V5(IROW,J) = V5(IROW,J) +
     X               V2(14,J)*QCCIV*PAYAV(3)/100.+
     X               V2(15,J)*QHCIV*PAYAV(4)/100.+
     X               V2(16,J)*QFCIV*PAYAV(4)/100.+
     X               V2(17,J)*QACIV*PAYAV(3)/100.+
     X               V2(18,J)*QBCIV*PAYAV(4)/100.+
     X               V2(19,J)*QMCIV*PAYAV(3)/100.
2600  CONTINUE
C
C
C
C TRAVEL OF PERSONNEL
C  IROW = 3
C  (SEE PCS/TDY CALCULATION)
C
C
C PRINTING AND REPRODUCTION
      IROW = 4
      DO 3500 J=1,6
      V5(IROW,J) = (V4(1,J)+V4(2,J)+V4(3,J))*1000.
3500  CONTINUE
C
C
C
C OTHER PURCHASED SERVICES
      IROW = 5
C     (ALSO SEE ROW 1 CALCULATION)
      DO 3600 J=1,6
      V5(IROW,J) = V5(IROW,J) +
     X               (V4(20,J)+V4(21,J)+V4(22,J)+V4(23,J))*1000.
3600  CONTINUE
C
C
C
C OTHER SUPPLIES AND EQUIPMENT
      IROW = 6
      DO 3700 J=1,6
      V5(IROW,J) = V5(IROW,J) + (V4(24,J)+V4(25,J))*1000.
3700  CONTINUE
C
C  IROW = 6,(16)
      NH = NTYPE(H)
      IF(NH .EQ. 0)GO TO 3750
      DO 3720 I=1,NH
      CALL HDWRE(I,DEBIT,CREDIT)
      IF(SFD(I).EQ.0)IROW=16
      IF(SFD(I).EQ.1)IROW=6
```

```
C
C
      DO 3710 J=1,6
      V5(IROW,J) = V5(IROW,J) + DEBIT(J)*HPCU(I)
     X                          + CREDIT(J)*HPCU(I)*CRV(I)/100.0
     X                          + DEBIT(J)*HRCUY(I)*HISR(I)/12.
3710  CONTINUE
3720  CONTINUE
C
3750  CONTINUE
C
C
C           MILITARY PERSONNEL
C
C OFFICER PAY
      IROW = 7
C     (ALSO SEE PAY AND ALLOWANCES CALCULATION)
      DO 3800 J=1,6
      V5(IROW,J) = V5(IROW,J) +
     X               PAYAV(1)/100.*(V2(14,J)*QCOFF +
     X                              V2(15,J)*QHOFF +
     X                              V2(16,J)*QFOFF +
     X                              V2(17,J)*QAOFF +
     X                              V2(18,J)*QBOFF +
     X                              V2(19,J)*QMOFF   )
3800  CONTINUE
C
C
C
C AIRMAN PAY
      IROW = 8
C     (ALSO SEE PAY AND ALLOWANCES CALCULATION)
      DO 3900 J=1,6
      V5(IROW,J) = V5(IROW,J) +
     X                          PAYAV(2)/100.*(V2(14,J)*QCAMN+
     X                                         V2(15,J)*QHAMN+
     X                                         V2(16,J)*QFAMN+
     X                                         V2(17,J)*QAAMN+
     X                                         V2(18,J)*QBAMN+
     X                                         V2(19,J)*QMAMN )
3900  CONTINUE
C
C
C PCS
C     IROW = 9
C     (SEE PCS/TDY CALCULATION)
C
C
C DIVIDE ROWS 1-9 BY $1000, AND ROUND TO 1 DEC. PLACE
C
4300  DO 4400 I=1,9
      DO 4400 J=1,6
      V5(I,J) = ROUND1(V5(I,J)/1000.)
4400  CONTINUE
```

```
C
C
C           TOTAL PROGRAM 8
C
      IROW = 10
      DO 4500 J=1,6
      DO 4500 I=1,9
      V5(IROW,J) = V5(IROW,J) + V5(I,J)
4500  CONTINUE
C
C
C           * PROGRAM 5 *
C
5000  CONTINUE
C
C
C           OPERATIONS AND MAINTENANCE
C
C CIVILIAN PERSONNEL
C  IROW=11
C (SEE PAY AND ALLOWANCE CALCULATION)
C
C
C CIVILIAN PCS/TDY
C  IROW=12
C (SEE PCS/TDY CALCULATION)
C
C
C           NATIONAL GUARD/RESERVE PERSONNEL
C
C OFFICER, AIRMAN PAY
C    IROW=13,14
C    (SEE PAY AND ALLOWANCES CALCULATION)
      CONTINUE
C
C
C ACTIVE DUTY GUARD/RESERVE PCS/TDY
C  IROW=15
C (SEE PCS/TDY CALCULATION)
C
C
C           * OTHER AIR FORCE PROGRAMS *
C
5100  CONTINUE
C
C
C
C           AIRCRAFT, MISSILE, OTHER PROCUREMENT
C  IROW=16
C (SEE ROW 6 CALCULATION)
```

```
C
C
C           OPERATIONS AND MAINTENANCE
C
C CIVILIAN PERSONNEL
C  IROW=17
C (SEE PAY AND ALLOWANCES CALCULATION)
C
C
C TRAVEL OF PERSONNEL
C  IROW=18
C (SEE PCS/TDY CALCULATION)
C
C
C           MILITARY PERSONNEL
C
C
C OFFICER, AIRMAN PAY
C  IROW=19,20
C (SEE PAY AND ALLOWANCES CALCULATION)
C
C
C DIVIDE ROWS 11-20 BY $1000, AND ROUND TO 1 DEC. PLACE
C
      DO 5700 I=11,20
      DO 5700 J=1,6
      V5(I,J) = ROUND1(V5(I,J)/1000.)
5700  CONTINUE
C
C
C           TOTAL AIR FORCE
C
      IROW=21
      DO 5800 J=1,6
      DO 5800 I=10,20
      V5(IROW,J) = V5(IROW,J) + V5(I,J)
5800  CONTINUE
C
C
C           *** OTHER DOD ***
C
5825  CONTINUE
C
C
C           OPERATIONS AND MAINTENANCE
C
C CIVILIAN PERSONNEL
C  IROW=22
C (SEE PAY AND ALLOWANCES CALCULATION)
C
C
C TRAVEL OF PERSONNEL
C  IROW=23
C (SEE PCS/TDY CALCULATION)
C
```

```
C
C
C           MILITARY PERSONNEL
C
C OFFICER, AIRMAN PAY
C  IROW=24,25
C (SEE PAY AND ALLOWANCES CALCULATION)
      CONTINUE
C
C
C PCS
C  IROW=26
C (SEE PCS/TDY CALCULATION)
C
C
C           *** NON-DOD ***
C
5850  CONTINUE
C
C
C  IROW=27
C (SEE PAY AND ALLOWANCES CALCULATION)
C
C
C DIVIDE ROWS 22-27 BY $1000, AND ROUND TO 1 DEC. PLACE
C
      DO 5900 I=22,27
      DO 5900 J=1,6
      V5(I,J) = ROUND1(V5(I,J)/1000.)
5900  CONTINUE
C
C
C           TOTAL COURSE COST
C
5875  CONTINUE
C
C
      IROW = 28
      DO 6000 J=1,6
      DO 6000 I=21,27
      V5(IROW,J) = V5(IROW,J) + V5(I,J)
6000  CONTINUE
C
C
C   ROW TOTALS
C
      DO 6100 I=1,28
      DO 6100 J=1,6
      V5(I,7) = V5(I,7) + V5(I,J)
6100  CONTINUE
```

```
C
C
C          *** PRINT ***
C
C
      CALL HEAD
C
C
      WRITE(6,7100)
7100  FORMAT( 1H0, 24X, 34HPROGRAM/APPROPRIATION COST SUMMARY,
     X        26H (IN THOUSANDS OF DOLLARS)  / 25X, 30(2H==) / 1X /
     X        86X, 4HYEAR / 1X /
     X        64X, 1H0, 9X, 1H1, 9X, 1H2, 9X, 1H3, 9X, 1H4,
     X         9X, 1H5, 9X, 5HTOTAL /
     X        58X, 6(3X, 7H=======), 5X, 7H======= )
C
      WRITE(6,7200) ((V5(I,J), J=1,7), I=1,4  )
7200  FORMAT( 1X,  9HAIR FORCE  /
     X        3X, 46HPROGRAM 8 - TRAINING, MEDICAL, OTHER PERSONNEL,
     X        7H ACTIV. /
     X        5X, 28HMILITARY CONSTRUCTION (3300),
     X       25X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 33HOPERATIONS AND MAINTENANCE (3400)  /
     X        7X, 18HCIVILIAN PERSONNEL ,
     X       33X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 19HTRAVEL OF PERSONNEL,
     X       32X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 25HPRINTING AND REPRODUCTION ,
     X       26X, 6(2X, F8.1), 3X, F9.1  )
C
      WRITE(6,7300) ((V5(I,J), J=1,7), I=5,10  )
7300  FORMAT( 7X, 24HOTHER PURCHASED SERVICES,
     X       27X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 28HOTHER SUPPLIES AND EQUIPMENT,
     X       23X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 25HMILITARY PERSONNEL (3500)  /
     X        7X, 11HOFFICER PAY ,
     X       40X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 10HAIRMAN PAY ,
     X       41X, 6(2X, F8.1), 3X, F9.1  /
     X        7X,  3HPCS ,
     X       48X, 6(2X, F8.1), 3X, F9.1  /
     X        58X, 6(3X, 7H=======), 5X, 7H======= /
     X         3X, 15HTOTAL PROGRAM 8 ,
     X       40X, 6(2X, F8.1), 3X, F9.1 / 1X    )
```

```
C
C
      WRITE(6,7400) ((V5(I,J), J=1,7), I=11,15  )
7400  FORMAT( 3X, 36HPROGRAM 5 - GUARD AND RESERVE FORCES /
     X        5X, 48HOPERATIONS AND MAINTENANCE - ANG/AFR (3840/3740) /
     X        7X, 18HCIVILIAN PERSONNEL,
     X       33X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 16HCIVILIAN PCS/TDY,
     X       35X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 44HNATIONAL GUARD/RESERVE PERSONNEL (3850/3700)  /
     X        7X, 11HOFFICER PAY,
     X       40X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 10HAIRMAN PAY,
     X       41X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 33HACTIVE DUTY GUARD/RESERVE PCS/TDY ,
     X       18X, 6(2X, F8.1), 3X, F9.1  )
C
      WRITE(6,7500) ((V5(I,J),J=1,7), I=16,20 )
7500  FORMAT( 3X, 39HOTHER AIR FORCE PROGRAMS (1-4,6,7,9,10)  /
     X        5X, 50HAIRCRAFT, MISSILE, OTHER PROCURE. (3010,3020,3080),
     X        3X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 33HOPERATIONS AND MAINTENANCE (3400)  /
     X        7X, 18HCIVILIAN PERSONNEL,
     X       33X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 19HTRAVEL OF PERSONNEL,
     X       32X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 25HMILITARY PERSONNEL (3500)  /
     X        7X, 11HOFFICER PAY,
     X       40X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 10HAIRMAN PAY,
     X       41X, 6(2X, F8.1), 3X, F9.1  /
     X        58X, 6(3X, 7H=======), 5X, 7H=======   )
C
      WRITE(6,7600) ((V5(I,J),J=1,7), I=21,24 )
7600  FORMAT( 3X, 15HTOTAL AIR FORCE,
     X       40X, 6(2X, F8.1), 3X, F9.1  / 1X /
     X        1X,  9HOTHER DOD /
     X        5X, 26HOPERATIONS AND MAINTENANCE  /
     X        7X, 18HCIVILIAN PERSONNEL,
     X       33X, 6(2X, F8.1), 3X, F9.1  /
     X        7X, 19HTRAVEL OF PERSONNEL,
     X       32X, 6(2X, F8.1), 3X, F9.1  /
     X        5X, 18HMILITARY PERSONNEL   /
     X        7X, 11HOFFICER PAY,
     X       40X, 6(2X, F8.1), 3X, F9.1   )
C
      WRITE(6,7700) ((V5(I,J),J=1,7), I=25,2C )
7700  FORMAT( 7X, 10HAIRMAN PAY,
     X       41X, 6(2X, F8.1), 3X, F9.1  /
     X        7X,  3HPCS,
     X       48X, 6(2X, F8.1), 3X, F9.1  /
     X        1X,  7HNON-DOD,
     X       50X, 6(2X, F8.1), 3X, F9.1  /
     X       58X, 6(3X, 7H=======), 5X, 7H======= /
     X        3X, 17HTOTAL COURSE COST,
     X       38X, 6(2X, F8.1), 3X, F9.1   )
```

```
C
C
      WRITE(6,7800)
7800  FORMAT(1HO, 44HNOTE: BECAUSE OF ROUNDING DIFFERENCES, TOTAL,
     X            39H COURSE COSTS ON THE FUNCTIONAL AND THE,
     X            44H PROG/APPROP. SUMMARIES MAY NOT BE IDENTICAL)
      RETURN
      END
```

```
C
C
      SUBROUTINE OUT6
      RETURN
      END
      SUBROUTINE OUT7
      RETURN
      END
      SUBROUTINE OUT8
      RETURN
      END
```

```
C
C
C*************************************************************************
C   SUBROUTINE TO LOOK UP PAY FACTOR FROM TABLES
C*************************************************************************
C
      SUBROUTINE PAYGR(IPG,IPD,PG)
      DIMENSION PAY(20,5),PAYAV(5)
      COMMON/PAY/ PAY, PAYAV
C
      IF(IPG .EQ. 0)GO TO 100
C
      PG = PAY(IPG,IPD)
C
      GO TO 200
C
C PAY GRADE = 0 OR BLANK. USE AVG.
C
100   PG = PAYAV(IPD)
C
200   RETURN
      END
```

```
C
C
C*************************************************************************
C            HARDWARE DEBIT -- CREDIT
C*************************************************************************
C
      SUBROUTINE HDWRE(I, DEBIT, CREDIT)
      INTEGER HID, HC, HOD
C
      DIMENSION AV(6),ALOSS(6),PROC(6),DEBIT(6),CREDIT(6),
C
     X          HID(75),HC(75),HOD(75),HTYPE(15,75),
     X HNURQ(5,75),SFD(75),CRV(75),HCMTC(75),HPCU(75),HAAF(75),
     X HRCUY(75),
     X          HISR(75)
      COMMON/H/ HID,HC,HOD,HTYPE,HNURQ,SFD,CRV,HCMTC,
     X          HPCU,HAAF,HRCUY,HISR
C
      CALL INITF(AV,6)
      CALL INITF(ALOSS,6)
      CALL INITF(PROC,6)
      HAAFP = HAAF(I)/100.
C YEAR 1
      ALOSS(1) = ROUND0( HAAFP*HNURQ(1,I) )
      PROC(1) = HNURQ(1,I)+ALOSS(1)
C YEARS 2-5
      DO 1600 J=2,5
      ALOSS(J) = ROUND0( HAAFP*HNURQ(J,I) )
      PROC(J) = HNURQ(J,I)+ALOSS(J) - HNURQ(J-1,I)
 1600 CONTINUE
      ALOSS(6) = 0.0
      PROC(6) = - HNURQ(5,I)
C DEBIT-CREDIT -- YEARS 1-6
      DO 1700 J=1,6
      DEBIT(J) = AMAX1(PROC(J), 0.)
      CREDIT(J) = AMIN1(PROC(J), 0.)
1700  CONTINUE
C
      RETURN
      END
```

```
C
C
C*************************************************************************
C           PCS -- STUDENT MOVES
C*************************************************************************
C
      SUBROUTINE PCSST(I, PCSOFF, PCSAMN, PCSCIV)
      INTEGER ST,SPD,SPG,SIM
      DIMENSION PCSOFF(5),PCSAMN(5),PCSCIV(5),
C
     X          ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75)
C
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
C
      IPD = SPD(I)
      CALL INITF(PCSOFF,5)
      CALL INITF(PCSAMN,5)
      CALL INITF(PCSCIV,5)
4100  DO 4500 J=1,5
      SMOVES = SENTS(J,I) + SNGRAD(J,I) + SNWASH(J,I)
      GO TO ( 4200, 4300, 4400, 4400, 5100), IPD
4200  PCSOFF(J) = SMOVES
      GO TO 4500
4300  PCSAMN(J) = SMOVES
      GO TO 4500
4400  PCSCIV(J) = SMOVES
      GO TO 4500
4500  CONTINUE
5100  RETURN
      END
```

```
C
C
C*************************************************************************
C           TDY -- STUDENT MOVES AND MAN-YEARS
C*************************************************************************
C
      SUBROUTINE TDYST(I, TDYEOF, TDYEAM, TDYECV,
     X                    TDYMOF, TDYMAM, TDYMCV )
      INTEGER ST, SPD, SPG, SIM
C
      DIMENSION TDYEOF(5),TDYEAM(5),TDYECV(5),
     X          TDYMOF(5),TDYMAM(5),TDYMCV(5),
C
     X          ST(75),SPD(75),SPG(75),SIM(75),
     X          SNGRAD(7,75),SMYRS(7,75),SENTS(7,75),SNWASH(7,75)
C
      COMMON/D/ DGCD,DWR,DWCD,DEI
      COMMON/S/ ST,SPD,SPG,SIM,SNGRAD,SMYRS,SENTS,SNWASH
C
      IPD = SPD(I)
      CALL INITF(TDYEOF,5)
      CALL INITF(TDYEAM,5)
      CALL INITF(TDYECV,5)
      CALL INITF(TDYMOF,5)
      CALL INITF(TDYMAM,5)
      CALL INITF(TDYMCV,5)
4600  DO 5000 J=1,5
      SMOVES = SENTS(J,I) + SNGRAD(J,I) + SNWASH(J,I)
      GO TO ( 4700, 4800, 4900, 4900, 5100), IPD
C OFFICERS
4700  TDYEOF(J) = SMOVES
      TDYMOF(J) = SMYRS(J,I)
      GO TO 5000
C AIRMEN
4800  TDYEAM(J) = SMOVES
      TDYMAM(J) = SMYRS(J,I)
      GO TO 5000
C CIVILIANS
4900  TDYECV(J) = SMOVES
      TDYMCV(J) = SMYRS(J,I)
      GO TO 5000
5000  CONTINUE
5100  RETURN
      END
```

```
C
C
C*************************************************************************
C           PCS -- INSTRUCTOR MOVES AND EDUC. REQUIREMENTS
C*************************************************************************
C
      SUBROUTINE PCSIN(I, AMOVOF, AMOVAM, AMOVCV, EDREQ )
      INTEGER TT,TPD,TPG
C
      DIMENSION FC(6),TVR(6),EDREQ(6),
     X          AMOVOF(6),AMOVAM(6),AMOVCV(6),
C
     X          TT(25),TPD(25),TPG(25),TSIIC(25),TN(6,25),
     X          TNMOB(25),TIFTC(25),TETC(25),
     X          TTR(25)
C
      COMMON/T/ TT,TPD,TPG,TSIIC,TN,TTR,TNMOB,TIFTC,TETC
C
      CALL INITF(AMOVOF,6)
      CALL INITF(AMOVAM,6)
      CALL INITF(AMOVCV,6)
      IPD = TPD(I)
C YEAR 0
      FC(1) = 0.0
      IF(TNMOB(I) .EQ. 0.)GO TO 5500
      FC(1) = (TN(1,I)/TNMOB(I))*12.
5500  TVR(1) = 0.
      EDREQ(1) = FC(1)
C YEARS 1-5
      DO 5600 J=2,6
      FC(J) = TN(J,I)-TN(J-1,I)
      IF(J.EQ.2)FC(J)=TN(J,I)-FC(J-1)
      TVR(J) = TN(J,I)*TTR(I)/100.
      EDREQ(J) = AMAX1(FC(J),0.)+TVR(J)
5600  CONTINUE
C
      DO 6000 J=1,6
      AMOVE = ABS(FC(J))+2.0*TVR(J)
      GO TO (5700, 5800, 5900, 5900),IPD
C OFFICERS
C
5700  AMOVOF(J) = AMOVE
      GO TO 6000
C AIRMEN
C
5800  AMOVAM(J) = AMOVE
      GO TO 6000
C CIVILIANS
C
5900  AMOVCV(J) = AMOVE
      GO TO 6000
6000  CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C***  TITLE 1  ***
C*************************************************************************
      SUBROUTINE TITLE1
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39)
      COMMON /ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X             U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
C
      CALL HEAD
      WRITE(6,9010)
9010  FORMAT(1HO,49X,10HINPUT DATA/50X,2(5H=====)/1X/1X)
      WRITE(6,9020)
9020  FORMAT(21X,1H1,9X,1H2,9X,1H3,9X,1H4,9X,1H5,9X,1H6,9X,
     1  1H7,9X,1H8/  12X,1H1,8X,8(1HO,9X)/  12X,20(4H....)/1X/1X)
      NLINES = 12
      RETURN
      END
```

```
C
C
C*************************************************************************
C ***  TITLE 2  ***
C*************************************************************************
      SUBROUTINE TITLE2
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39)
      COMMON /ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X             U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
C
      CALL HEAD
      WRITE(6,8010)
8010  FORMAT(1HO, 31X, 31H    ERROR MESSAGES       (NOTE:,
     1        35H ONLY ONE ERROR PER CARD IS LISTED)/
     2          36X, 7(2H==) / 1X )
      NLINES = 6
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** PRINT HEADING ***
C*************************************************************************
C
      SUBROUTINE HEAD
      DATA BLANK/2H  /
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39), TITLEC(55)
      COMMON /ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X            .U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
C
      CALL INITA(TITLEC,55)
      IPAGE = IPAGE+1
      NLINES = 2
      IF(NITYPE(U) .EQ. 0) GO TO 7700
C
C ** CENTER TITLE **
C
C FIND FIRST NON-BLANK WORD
      DO 7100 I=1,39
      IF(TITLE(I) .EQ. BLANK)GO TO 7100
      IFIRST = I
      GO TO 7200
7100  CONTINUE
C ALL BLANK. USE DEFAULT TITLE.
      GO TO 7700
C
C FIND LAST NON-BLANK WORD
7200  I = 39
7250  IF(TITLE(I) .EQ. BLANK)GO TO 7300
      ILAST = I
      GO TO 7400
7300  I = I-1
      GO TO 7250
C
C MOVE TITLE ARRAY TO CENTERED-TITLE ARRAY
7400  NW = ILAST-IFIRST+1
      II = 27-NW/2
      DO 7500 I=1,NW
      I1 = II+I
      I2 = IFIRST+I-1
      TITLEC(I1) = TITLE(I2)
7500  CONTINUE
      WRITE(6,7600)TITLEC,IPAGE
7600  FORMAT(1H1, 55A2, 4HPAGE, I4)
      GO TO 7900
C
C NO TITLE CARD FOUND. USE DEFAULT TITLE.
7700  WRITE(6,7800)IPAGE
7800  FORMAT(1H1,32X,28H    *** MODIA COST MODEL ***,
     1  49X,4HPAGE,I4)
7900  CONTINUE
      WRITE(6,7910)
7910  FORMAT(1X, 64(2H**))
      RETURN
      END
```

```
C
C
C*************************************************************************
C SUBROUTINE TO ZERO AN INTEGER ARRAY
C*************************************************************************
      SUBROUTINE INITI(IARRAY,N)
      DIMENSION IARRAY(375)
      DO 10 I=1,N
      IARRAY(I) = 0
10    CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C SUBROUTINE TO ZERO A FLOATING ARRAY
C*************************************************************************
      SUBROUTINE INITF(ARRAY,N)
      DIMENSION ARRAY(375)
      DO 10 I=1,N
      ARRAY(I) = 0.
10    CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C SUBROUTINE TO BLANK AN ARRAY
C*************************************************************************
      SUBROUTINE INITA(ARRAY,N)
      DIMENSION ARRAY(375)
      DATA BLANK/2H    /
      DO 10 I=1,N
      ARRAY(I) = BLANK
10    CONTINUE
      RETURN
      END
```

```
C
C
C*************************************************************************
C       FUNCTION TO ROUND TO AN INTEGER
C*************************************************************************
C
      FUNCTION ROUND0(X)
      ROUND0 = AINT(X + SIGN(1.,X)*.50002)
      RETURN
      END
```

```
C
C
C*************************************************************************
C       FUNCTION TO ROUND TO ONE DECIMAL PLACE
C*************************************************************************
C
      FUNCTION ROUND1(X)
      ROUND1 = AINT(X*10. + SIGN(1.,X)*.5002)/10.
      RETURN
      END
```

```
C
C
C*************************************************************************
C ***  ERROR MESSAGES  ***
C*************************************************************************
      SUBROUTINE ERROR(NERR, II, KK)
      INTEGER   U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
      DIMENSION NITYPE(20), NTYPE(20), TITLE(39)
      COMMON /ALL/ NITYPE,NTYPE,LPP,NLINES,IPAGE,TITLE,IFLAG,
     X             U,D,S,T,C,R,H,E,F,G,A,B,O,OO,P
C
      IF(NLINES .EQ. 0) CALL TITLE2
      IF(NLINES .GE. LPP) CALL TITLE2
      GO TO(10,20,30,40,50,60,70,80,90,100,110,120,130,140,150,160,
     1  170,180,190,200,210,220,230,240,250,260,270,280,290,300,
     2  310,320,330,340,350,360,370,380,390,400,410,420,430,440,
     3  450),NERR
C
10    WRITE(6,15)II,KK
15    FORMAT(2H0*, 30HILLEGAL INPUT FORMAT ON CARD #,I3,
     1   45H. CARD EXCLUDED FROM MODEL. LEGAL RANGE = 01-,I2,1H.)
      GO TO 990
20    WRITE(6,25)II,KK
25    FORMAT(2H0*, 45HMORE THAN 1 COURSE DURATION CARD ENCOUNTERED.,
     1    7H CARD #, I3, 17H WAS USED. CARD #, I3,
     2   21H EXCLUDED FROM MODEL.)
      GO TO 990
30    WRITE(6,35)KK
35    FORMAT(2H0*, 37HILLEGAL STUDENT PERSONNEL DESIGNATOR.,
     1   28H LEGAL RANGE = 01-05. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
40    WRITE(6,45)KK
45    FORMAT(2H0*, 49HILLEGAL STUDENT TYPE. LEGAL RANGE = 01-07. CARD #,
     1  I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
50    WRITE(6,55)II,KK
55    FORMAT(2H0*, 44HDUPLICATE STUDENT TYPE-PERSONNEL DESIGNATOR-,
     1  17HPAY GRADE. CARD #, I3, 17H WAS USED. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
60    WRITE(6,65)KK
65    FORMAT(2H0*, 40HILLEGAL INSTRUCTOR PERSONNEL DESIGNATOR.,
     1  28H LEGAL RANGE = 01-04. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
70    WRITE(6,75)II,KK
75    FORMAT(2H0*, 40HDUPLICATE PERSONNEL DESIGNATOR-PAY GRADE,
     1  28H ON INSTRUCTOR INPUT. CARD #, I3, 17H WAS USED. CARD #,
     2    I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
80    WRITE(6,85)KK
85    FORMAT(2H0*, 32HCOURSEWARE ID MISSING OR INVALID,
     1  40H ON COURSEWARE PROCUREMENT INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
```

```
C
C
90    WRITE(6,95)II,KK
95    FORMAT(2H0*, 37HDUPLICATE COURSEWARE ID ON COURSEWARE,
     1 26H PROCUREMENT INPUT. CARD #, I3, 10H WAS USED.,
     2  7H CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
100   WRITE(6,105)KK
105   FORMAT(2H0*, 32HCOURSEWARE ID MISSING OR INVALID,
     1  37H ON CURRICULUM MANPOWER INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
110   WRITE(6,115)II,KK
115   FORMAT(2H0*, 23HDUPLICATE COURSEWARE ID,
     1  37H ON CURRICULUM MANPOWER INPUT. CARD #, I3,
     2  17H WAS USED. CARD #, I3,  21H EXCLUDED FROM MODEL.)
      GO TO 990
120   WRITE(6,125)KK
125   FORMAT(2H0*, 31HEQUIPMENT ID MISSING OR INVALID,
     1  38H ON HARDWARE PROCUREMENT INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
130   WRITE(6,135)II,KK
135   FORMAT(2H0*, 33HDUPLICATE HARDWARE ID ON HARDWARE,
     1  26H PROCUREMENT INPUT. CARD #, I3, 10H WAS USED.,
     2   7H CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
140   WRITE(6,145)KK
145   FORMAT(2H0*, 30HHARDWARE ID MISSING OR INVALID,
     1  39H ON HARDWARE MTC MANPOWER INPUT. CARD #,
     2    I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
150   WRITE(6,155)II,KK
155   FORMAT(2H0*, 33HDUPLICATE HARDWARE ID ON HARDWARE,
     1  27H MTC MANPOWER INPUT. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
160   WRITE(6,165)KK
165   FORMAT(2H0*, 33HFACILITY ID MISSING OR INVALID ON,
     1  35H FACILITY PROCUREMENT INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
170   WRITE(6,175)II,KK
175   FORMAT(2H0*, 33HDUPLICATE FACILITY ID ON FACILITY,
     1  26H PROCUREMENT INPUT. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
180   WRITE(6,185)KK
185   FORMAT(2H0*, 33HFACILITY ID MISSING OR INVALID ON,
     1  36H FACILITY MTC MANPOWER INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
```

```
C
C
190   WRITE(6,195)II,KK
195   FORMAT(2H0*, 33HDUPLICATE FACILITY ID ON FACILITY,
     1  27H MTC MANPOWER INPUT. CARD #, I3, 10H WAS USED.,
     2   7H CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
200   WRITE(6,205)KK
205   FORMAT(2H0*, 42HINVALID PERSONNEL TYPE ON ADMIN.,BASE OP.,,
     1  50HAND MEDICAL PERSONNEL INPUT. LEGAL VALUES = 13-15.,
     2   7H CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
210   WRITE(6,215)II,KK
215   FORMAT(2H0*, 44HDUPLICATE PERSONNEL TYPE ON ADMIN.,BASE OP.,,
     1  35HAND MEDICAL PERSONNEL INPUT. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
220   WRITE(6,225)II,KK
225   FORMAT(2H0*, 36HMORE THAN 1 COMPUTER SERVICE CHARGES,
     1  25H CARD ENCOUNTERED. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
230   WRITE(6,235)KK
235   FORMAT(2H0*, 35HILLEGAL PERSONNEL DESIGNATOR ON PAY,
     1  45H FACTOR OVERRIDE INPUTS. LEGAL RANGE = 01-05.,
     2   7H CARD #; I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
240   WRITE(6,245)II,KK
245   FORMAT(2H0*, 31HDUPLICATE PERSONNEL DESIGNATOR-,
     1  47HPAY GRADE ON PAY FACTOR OVERRIDE INPUTS. CARD #,
     2    I3, 17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
250   WRITE(6,255)II,KK
255   FORMAT(2H0*, 38HMORE THAN 1 OFF/AIR/CIV OVERRIDES CARD,
     1  20H ENCOUNTERED. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
260   WRITE(6,265)KK
265   FORMAT(2H0*,  38HILLEGAL PERSONNEL DESIGNATOR-PAY GRADE,
     1  30H PAIR ON STUDENT INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
270   WRITE(6,275)KK
275   FORMAT(2H0*,  38HILLEGAL PERSONNEL DESIGNATOR-PAY GRADE,
     1  33H PAIR ON INSTRUCTOR INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
280   WRITE(6,285)KK
285   FORMAT(2H0*,  38HILLEGAL PERSONNEL DESIGNATOR-PAY GRADE,
     1  43H PAIR ON PAY FACTOR OVERRIDE INPUTS. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
290   WRITE(6,295)
295   FORMAT(2H0*,  35HSTUDENT ENTRY INTERVAL EQUALS ZERO.,
     1  17H  JOB TERMINATED.)
      GO TO 990
```

```
C
C
300   WRITE(6,305)II
305   FORMAT(2H0*,  46HONE OR MORE OF THE % OFF-AIR-CIV DISTRIBUTIONS,
     1  30H DOES NOT TOTAL 100% ON CARD #, I3,
     2  25H. TABLE VALUES WERE USED.)
      GO TO 990
310   WRITE(6,315)KK
315   FORMAT(2H0*,  30HILLEGAL VALUE FOR INPUT METHOD,
     1  47H ON STUDENT INPUT. LEGAL VALUES = 00,01. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
320   WRITE(6,325)KK
325   FORMAT(2H0*,  39HILLEGAL INSTRUCTOR TYPE. LEGAL VALUES =,
     1  14H 08,09. CARD #, I3,  21H EXCLUDED FROM MODEL.)
      GO TO 990
330   WRITE(6,335)KK
335   FORMAT(2H0*,  27HILLEGAL COURSEWARE CLASS ON,
     1  52H COURSEWARE PROCUREMENT INPUT. LEGAL VALUES = 01-04 ,
     2   7H CARD #, I3,  21H EXCLUDED FROM MODEL.)
      GO TO 990
340   WRITE(6,345)KK
345   FORMAT(2H0*,  44HILLEGAL VALUE FOR INPUT METHOD ON CURRICULUM,
     1  45H MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
350   WRITE(6,355)KK
355   FORMAT(2H0*,  25HILLEGAL HARDWARE CLASS ON,
     1  50H HARDWARE PROCUREMENT INPUT. LEGAL VALUES = 01-03.,
     2   7H CARD #, I3,  21H EXCLUDED FROM MODEL.)
      GO TO 990
360   WRITE(6,365)KK
365   FORMAT(2H0*,  46HILLEGAL VALUE FOR INPUT METHOD ON HARDWARE MTC,
     1  45H MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
370   WRITE(6,375)KK
375   FORMAT(2H0*,  42HILLEGAL VALUE FOR INPUT METHOD ON FACILITY,
     1  49H MTC MANPOWER INPUT. LEGAL VALUES = 01,02. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
380   WRITE(6,385)KK
385   FORMAT(2H0*,  46HILLEGAL VALUE FOR INPUT METHOD ON ADMIN., BASE,
     1  56H OP., AND MEDICAL PERSONNEL INPUT. LEGAL VALUES = 01,02.,
     2   7H CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
390   WRITE(6,395)KK
395   FORMAT(2H0*,  35HINCONSISTENT STUDENT TYPE-PERSONNEL,
     1  36H DESIGNATOR ON STUDENT INPUT. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
400   WRITE(6,405)KK
405   FORMAT(2H0*,  34HILLEGAL VALUE FOR CREDIT OPTION ON,
     1  51H HARDWARE PROCUREMENT INPUT. LEGAL VALUES = 0 OR 1.,
     2   7H CARD #, I3,   21H EXCLUDED FROM MODEL.)
      GO TO 990
```

```
C
C
410   WRITE(6,415)II,KK
415   FORMAT(2H0*, 40HMORE THAN 1 MISCELLANEOUS OVERRIDES CARD,
     1  20H ENCOUNTERED. CARD #, I3,
     2  17H WAS USED. CARD #, I3, 21H EXCLUDED FROM MODEL.)
      GO TO 990
420   WRITE(6,425)
425   FORMAT(4H0***,  41H NO LEGAL COURSE DURATION CARD WAS FOUND.,
     1  20H JOB TERMINATED. ***)
      GO TO 990
430   WRITE(6,435)II,KK
435   FORMAT(2H0*, 30HTHE MAXIMUM NO. OF FORMAT TYPE, I3,
     1  28H INPUTS WAS EXCEEDED. CARD #, I3,
     2  21H EXCLUDED FROM MODEL.)
      GO TO 990
440   WRITE(6,445)
445   FORMAT(2H0*, 43HGRADUATE COURSE DURATION EXCEEDS TWO YEARS.,
     1  20H PROGRAM TERMINATED.)
      GO TO 990
450   WRITE(6,455)
455   FORMAT(2H0*, 41HWASHOUT COURSE DURATION EXCEEDS ONE YEAR.,
     1  20H PROGRAM TERMINATED.)
      GO TO 990
C*************************************************************************
990   CONTINUE
      NLINES = NLINES+2
      RETURN
      END
```

```
C
C
C*************************************************************************
C *** PROGRAM CONSTANTS ***
C*************************************************************************
C
      BLOCK DATA
      DIMENSION QCONST(34)
C
      COMMON/Q/ QCOFF,QCAMN,QCCIV,  QHOFF,QHAMN,QHCIV,
     X          QFOFF,QFAMN,QFCIV,  QAOFF,QAAMN,QACIV,
     X          QBOFF,QBAMN,QBCIV,  QMOFF,QMAMN,QMCIV,
C
     X          QAHMPM,QAOMPM,QATDPM,QTHPD,QMSCPM,
     X          QCPMIO,QCPMIA,QCPMIC,QCPMSO,QCPMSA,QCPMSC,
     X          QTDYTC,QTDYOF,QTDYAM,QTDYCV,QDR
C
C
C
      EQUIVALENCE (QCOFF,QCONST(1))
C
      DATA QCOFF/  0.0 /, QCAMN/ 63.0 /, QCCIV/ 37.0 /,
     X     QHOFF/  2.0 /, QHAMN/ 72.0 /, QHCIV/ 26.0 /,
     X     QFOFF/  0.0 /, QFAMN/100.0 /, QFCIV/  0.0 /,
     X     QAOFF/  6.0 /, QAAMN/ 39.0 /, QACIV/ 55.0 /,
     X     QBOFF/  2.0 /, QBAMN/ 64.0 /, QBCIV/ 34.0 /,
     X     QMOFF/ 20.0 /, QMAMN/ 80.0 /, QMCIV/  0.0 /,
C
     X     QAHMPM/122.0 /, QAOMPM/144.0 /, QTHPD/  6.0/, QATDPM/20.99 /,
     X     QMSCPM/112.0 /, QCPMIO/1913.0 /, QCPMIA/1118.0 /,
     X     QCPMIC/1913.0 /, QCPMSO/1098.0 /, QCPMSA/480.0 /,
     X     QCPMSC/1098.0 /, QTDYTC/ 85.0 /,
     X     QTDYOF/ 11.0 /, QTDYAM/  4.0 /, QTDYCV/ 21.0 /,
     X     QDR/ 10.0 /
C
      END
```